February, 1947 Vol. 36, No. 2

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INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

The Shop Teachers' Professional Magazine

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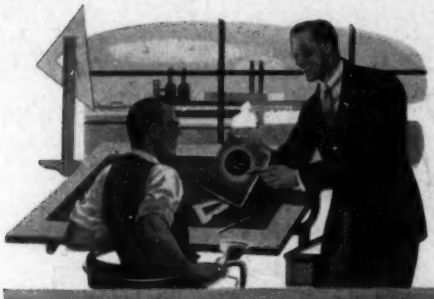
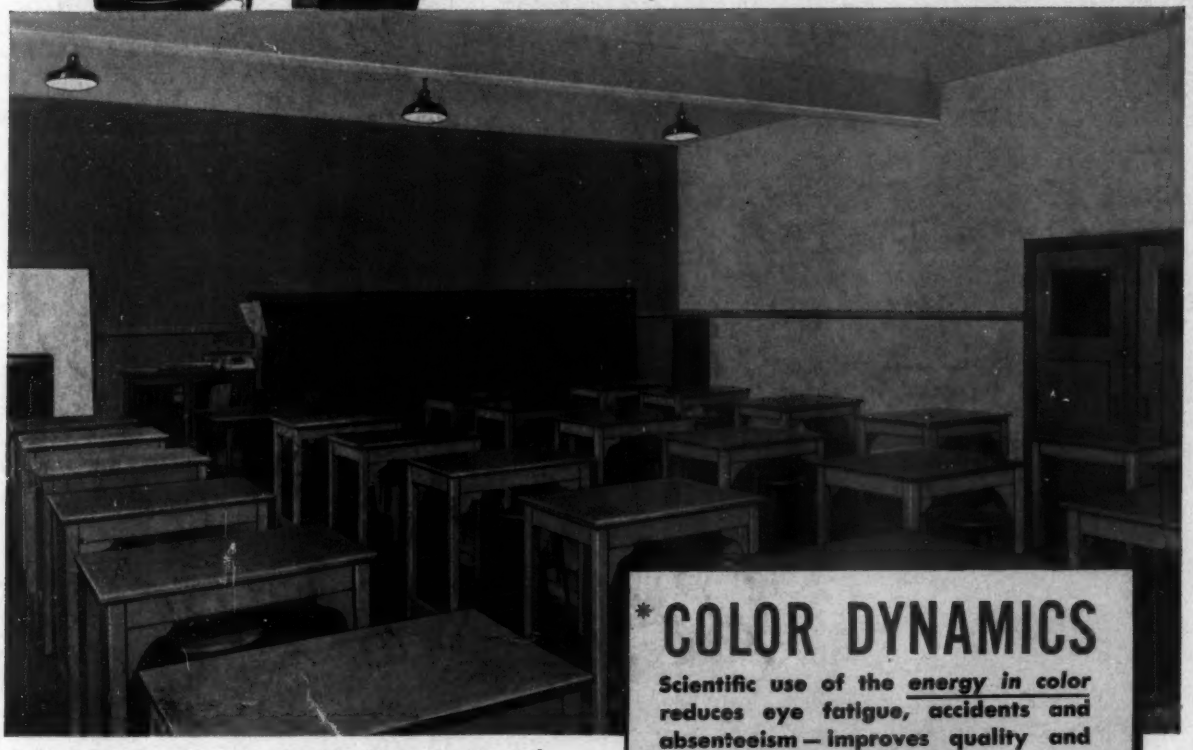


Start Now To Teach Your Vocational Students COLOR DYNAMICS*



*COLOR DYNAMICS

Scientific use of the *energy in color* reduces eye fatigue, accidents and absenteeism — improves quality and quantity of production!

● *Suggested color plan for vocational drafting room, decorated according to the principles of COLOR DYNAMICS*

HOW CAN A WORKER'S vision be improved so that tension and eye fatigue are lessened? How can the danger of accidents from mobile equipment and overhead conveyors be lessened? How can combinations of color improve working conditions and influence relationship between employees and management?

Industry is finding the answers to these and many similar questions in Pittsburgh's new science of COLOR DYNAMICS. For this new painting system is based upon the natural reactions of normal human beings to the *energy in color.*

Production executives are discovering by experience that color, properly "engineered" on a machine, on walls, ceilings and on floors, has a marked influence on the health, morale and skill of workers.

By using colors on operating parts of a machine which contrast with the materials being fabricated, the work is easier to see. Receding colors on the stationary parts of the machine and on walls provide eye-rest periods. Color symbols readily identify danger areas.

Labor and management benefit by such purposeful use of color. Continuity of employment is promoted. Efficiency of operation is improved, quality and quantity of production maintained!

That's why many educators in vocational schools now include COLOR DYNAMICS in their courses, giving students first-hand knowledge of a subject of great importance in their future work. A good way to teach COLOR DYNAMICS is to paint a machine or two, walls, floors and ceilings in your school shop!

Write today for a free copy of our book, "Color Dynamics for Industry". It contains detailed explanation of principles and methods. Address Pittsburgh Plate Glass Company, Paint Division, Dept. IV-2, Pittsburgh 22, Pa.

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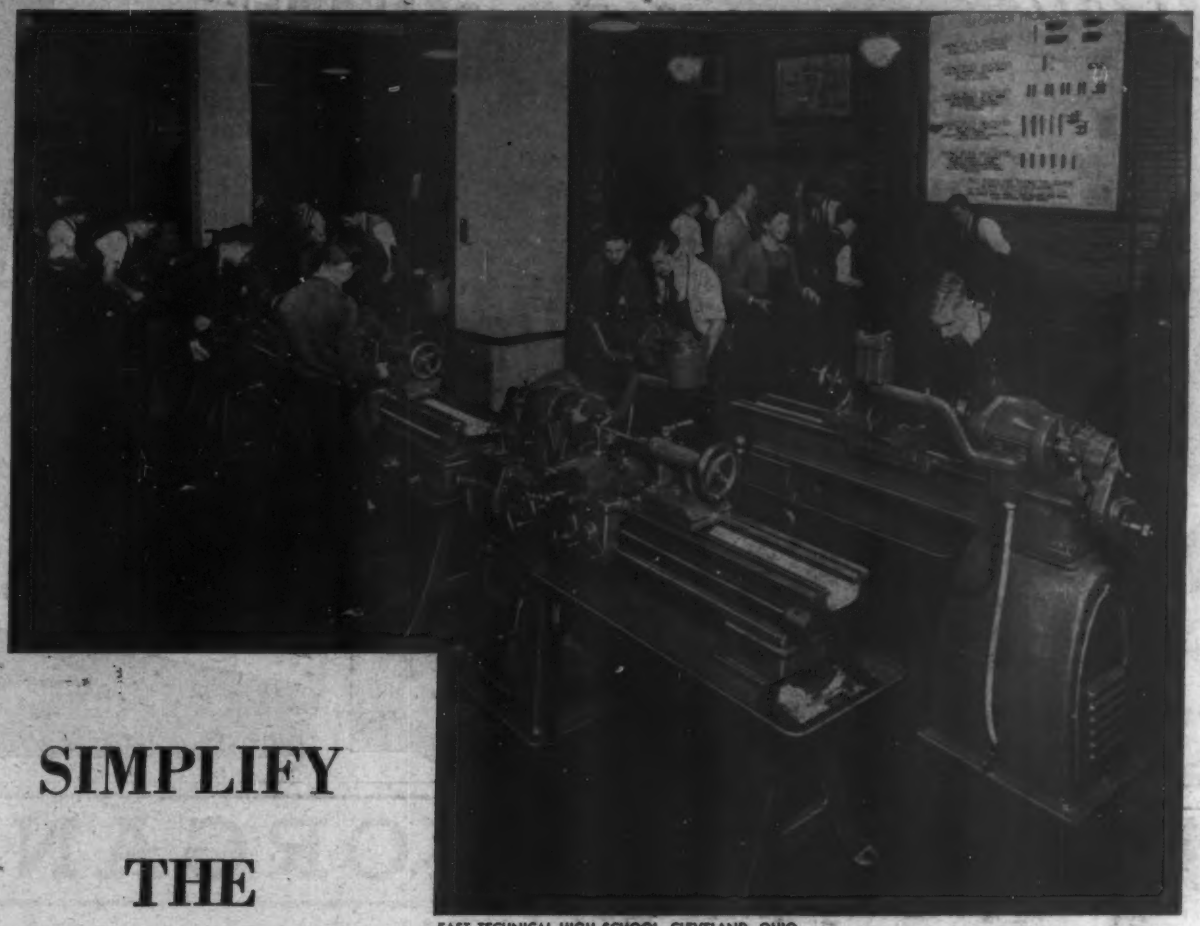

EAST TECHNICAL HIGH SCHOOL, CLEVELAND, OHIO

SIMPLIFY THE TEACHING OF MODERN SHOP PRACTICES WITH SOUTH BEND LATHES

The easiest and simplest way to teach modern shop techniques is with modern shop equipment. New methods, new materials and new precision came out of the war. Manufacturers learned to work to unprecedented degrees of accuracy; necessity forced the development of dozens of new materials—metals, alloys, and plastics. These new materials, improved methods and higher precision standards are here to stay.

The vocational student today must be trained according to the trends of the times. The problems of training are greatly simplified by using equipment that meets these new, more rigid requirements. That's why more and more schools everywhere are choosing modern South Bend Precision Lathes for teaching today's methods with today's materials.

Send for this catalog—Write today for Catalog 100-D which shows, in full color, all types, sizes and models of South Bend Precision Lathes. South Bend Lathes are made with 9-inch, 10-inch, 13-inch, 14½-inch, and 18-inch swings, and bed lengths to 12'. The complete line of South Bend attachments and accessories also is shown.

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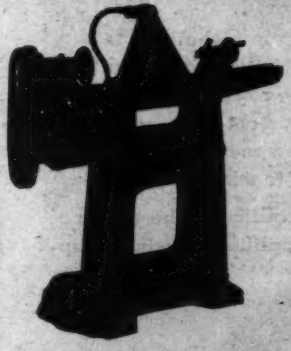

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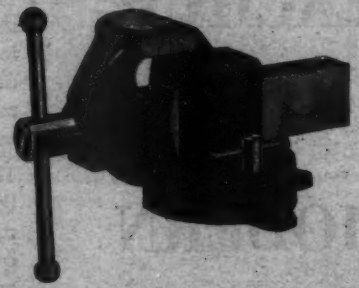

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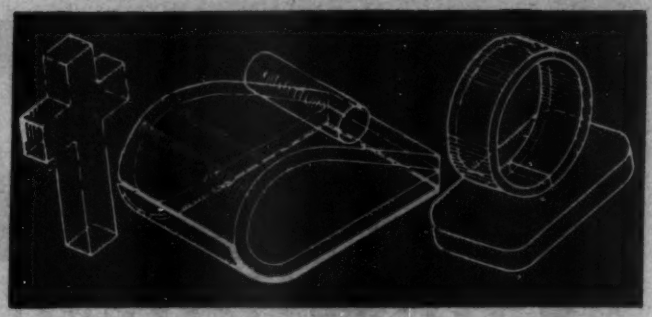

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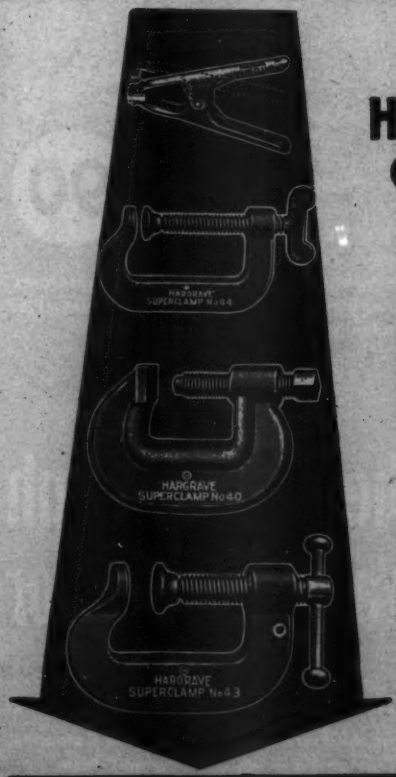

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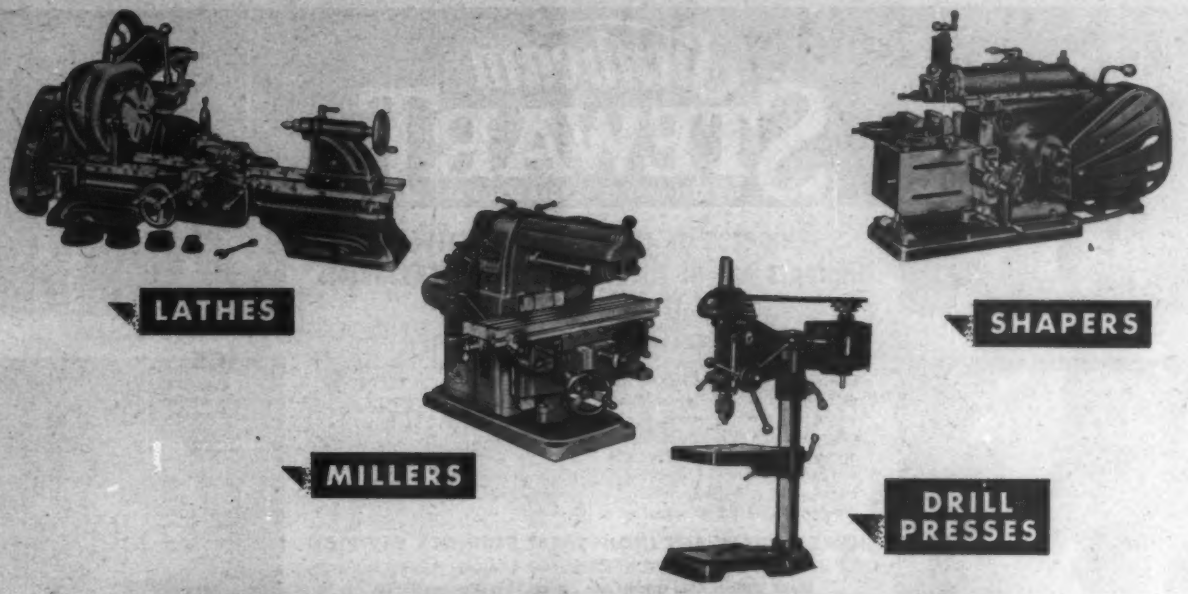

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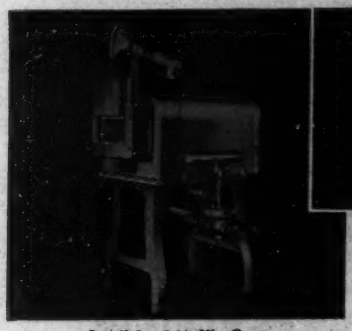

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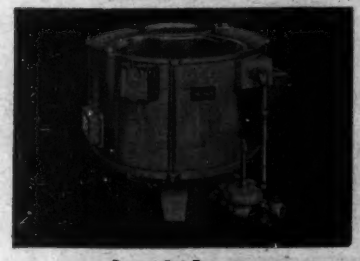

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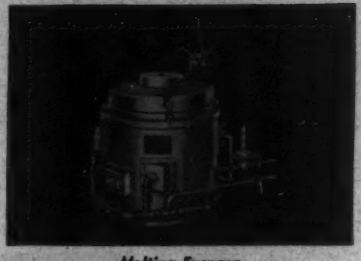

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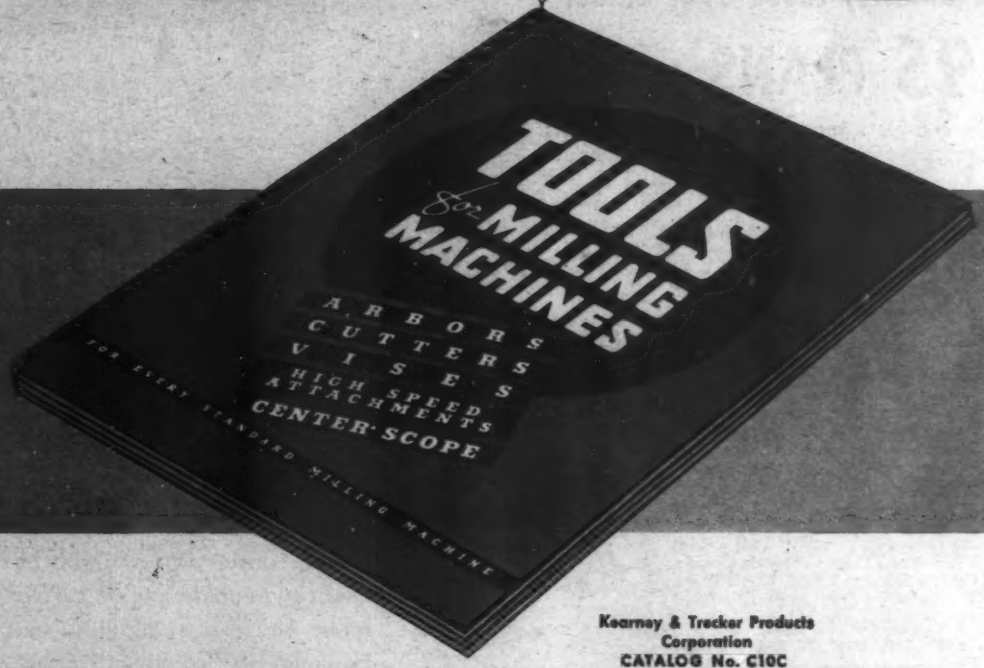

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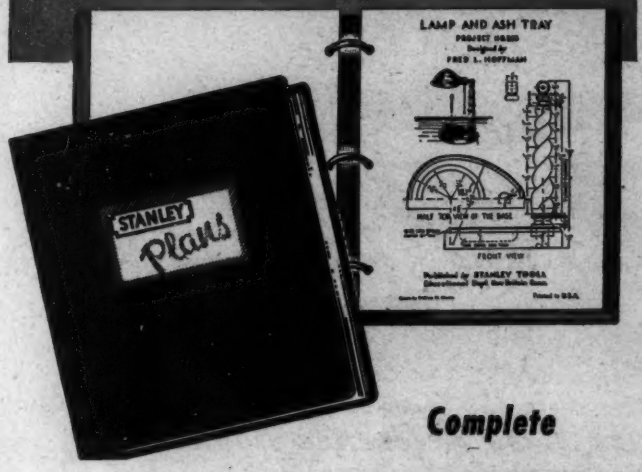

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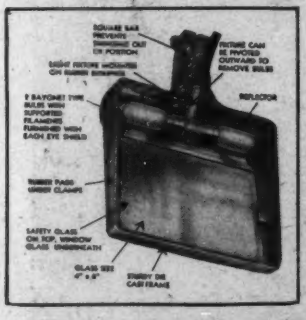

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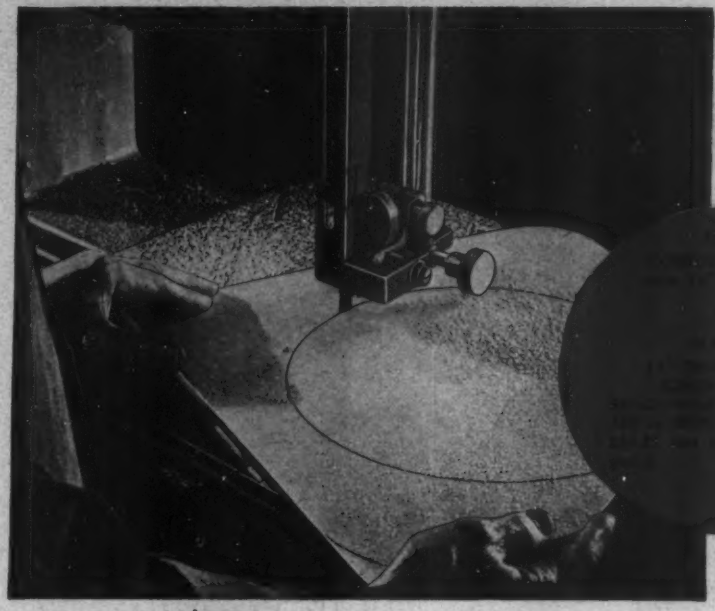

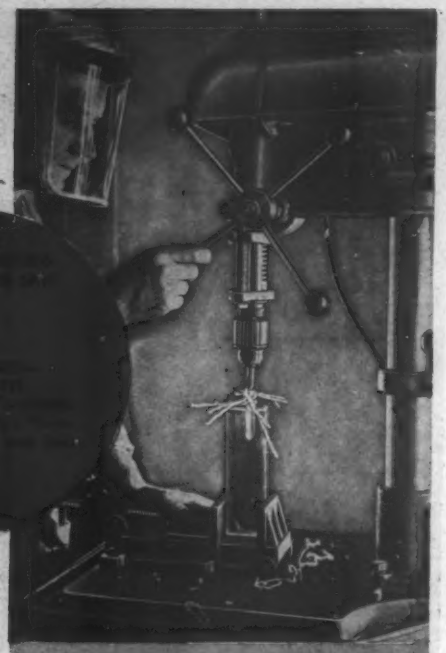

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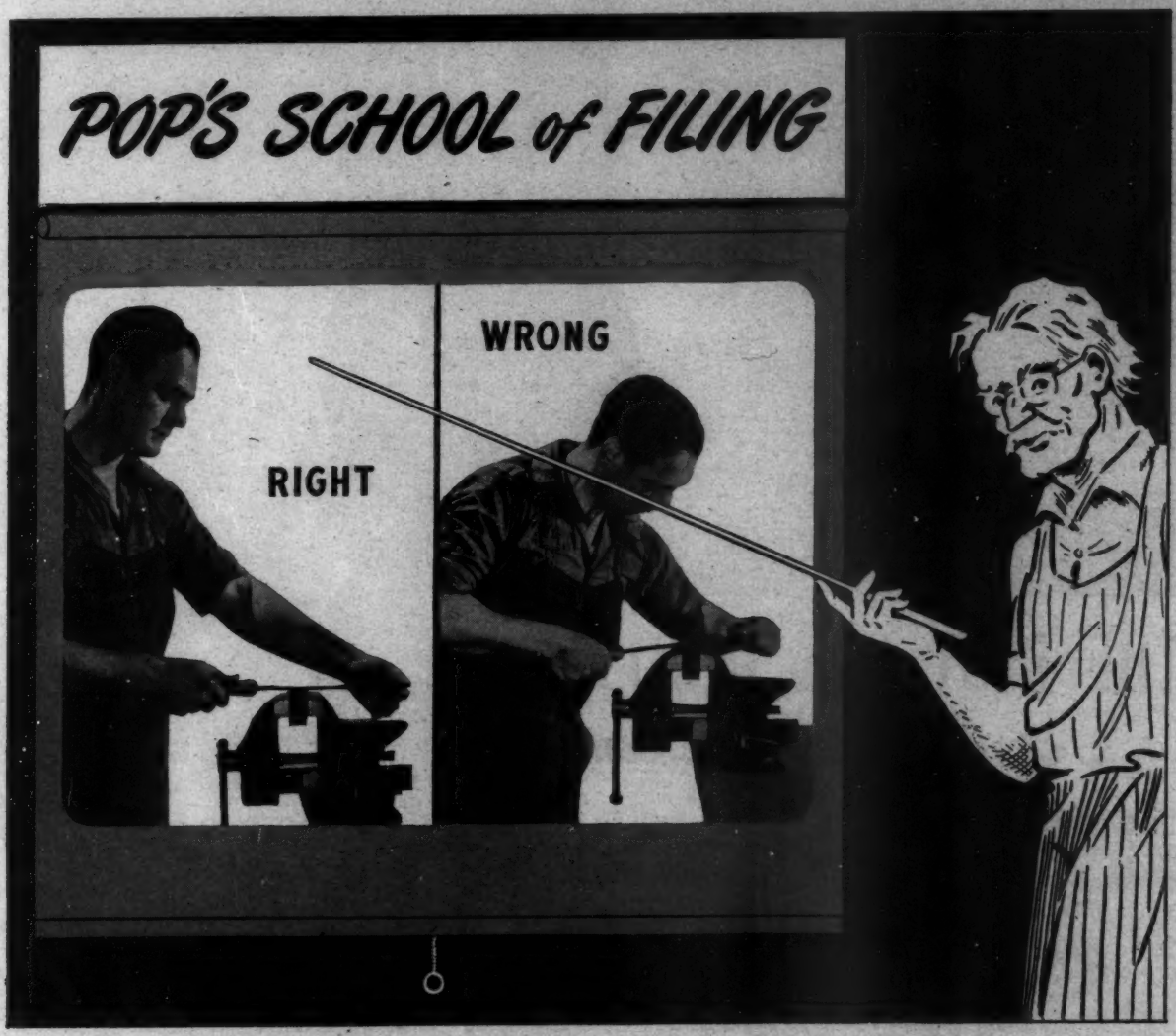

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POP'S QUIZ FOR TODAY

(Correct answers may be found on FILE FILOSOPHY pages indicated in parentheses)

1. What things is the mechanic in the "Wrong" picture doing incorrectly? (p. 30)
2. What three important things must the filer do right to do a good filing job? (p. 28)
3. What are the three elemental ways in which a file can be put to work manually? (pp. 28 and 29)
4. What is the proper height for work in vise for (a) general filing; (b) heavy filing; (c) delicate filing? (p. 29)
5. What accessories should be used for holding soft metals in vise for filing? For round pieces? (p. 29)
6. What is the most generally accepted way of holding a file for ordinary filing? (p. 29)
7. What is the proper grip for one-handed filing? (p. 29)
8. What is the proper way of "carrying" the file across the work? (pp. 29 and 30)
9. What is drawfiling and how should file be held and "carried"? (pp. 30 and 31)
10. How should file be held against work in lathe filing? (p. 31)
11. What general-purpose file is normally capable of doing good lathe-filing work? (p. 31)
12. What special file is made for lathe filing and what are its features or characteristics? (p. 31)

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VOL. 36, NO. 2 FEBRUARY, 1947

Industrial Arts and Vocational Education

THE SHOP TEACHERS' PROFESSIONAL MAGAZINE

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540 NO. MILWAUKEE ST., MILWAUKEE 1, WIS. | EASTERN OFFICE: 330 WEST 42ND ST., NEW YORK 18, N.Y.

▶ Testing and Tests

This issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION presents to its readers a variety of tests which may be found helpful by at least some shop instructors. A glance at the table of contents shows that there is testing material for both industrial-arts classes and vocational or trade classes.

As a matter of fact, quite frequently a test that has been written for an industrial-arts class will contain a number of items that may well be incorporated into tests for trade shops without any material change. The tests presented contain the usual types of items — completion, true and false, multiple choice, and matching — that are commonly found in the objective tests now commonly used. These tests were prepared for electrical trade classes, for print-shop classes, metalworking classes, woodworking classes, drafting classes (machine and architectural), and sheet-metal classes.

A perusal of the many items in these tests may show some that individual teachers would not incorporate in tests of their own. Frequently one or more of these so-called objectionable items prompt certain instructors to condemn an entire test. It would be better, by far, if each instructor would take the usable items out of these tests and embody them in his own, thereby saving time and energy, and probably construct a test which he might otherwise not have the time to make.

At any rate, INDUSTRIAL ARTS AND VOCATIONAL EDUCATION is presenting these tests to its readers for such use as they care to make of them. We trust that they will be found helpful.

▶ This Month's Cover

The illustration chosen for the February cover of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION pictures an apprentice working at a precision grinder. Photograph, courtesy of the R. K. Le Blond Machine Tool Company, Cincinnati 8, Ohio.

▶ Coming Conventions

January 31–February 2. American Camping Association (Middle East Regional Conference) at Cleveland, Ohio. Headquarters, Statler Hotel. Mrs. Edith Goranson, 750 Prospect Ave., Cleveland, Ohio.

February 27–28. American Camping Association (Southwest Regional Conference) at Kansas City, Mo. M. E. Mischler, Room 201, 1020 McGee St., Kansas City, Mo.

February 14–15. Oklahoma Vocational Education Association, at Oklahoma City, Okla. Secretary — Mr. Bonnie Nicholson, Oklahoma A. & M. College, Stillwater, Okla.

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FEBRUARY . . . 1947

Foremanship Training and the Conference Method

H. W. PAINE
Professor
Vocational Education
Teachers College
University of Cincinnati
Cincinnati, Ohio

(Continued from page 9 of the January, 1947, issue)

Topic: Evaluating a Training Program
Leader: H. W. Paine

Objectives

1. To determine desirable content for training programs at various levels to provide criteria against which to check content of similar programs.
2. To determine proper methodology for putting over training programs at various levels to provide criteria against which to check methods of similar programs.
3. To determine methods of determining whether programs are really doing good.

Introductory Statement

We have heard two most interesting and stimulating discussions of evaluation problems by Mr. Cooley and Mr. Magee and I believe you have already evaluated them in your minds at least as "tops."

The point raised by these two individuals as to "Who shall do the rating" is most interesting and I believe we shall agree that perhaps *many* people will do it. Obviously the training directors and their staffs who set up the objectives of the programs must make checks to determine the effectiveness of their work and to locate possible weakness and needs for change. They must also stand ready to help top management in its rating work.

The recipients of the training, the *customers*, will undoubtedly make personal evaluations of what they have experienced. Top management will rate the programs largely on a dollars and cents basis; that is, *Do they pay?* Here, as previously pointed out, the training directors must stand ready to help.

Now, in this conference, we shall add your ideas to those of Mr. Cooley and Mr. Magee to arrive at patterns of *content, method,* and *indications of results* that may be used as comparison or evaluation guides for other programs.

With your permission we shall set up evaluation data for four of the training programs listed by our two speakers under "Points To Be Checked in Evaluating":

I. Training Program for Executive Management
II. Training Program for Supervisory Management
III. Training Program for Apprenticeship Groups
IV. Training Program for on the Job or Employee Training

Obviously there are other areas of training but analyzing these four will give us data indicative of materials needed for evaluating other fields.

As previously mentioned we shall set up three areas of evaluation for each type of program, viz., *content, method,* and *indications* of *results* as disclosed in the three sections of the following tabulation.

Section A. What materials should be presented in the program?
Section B. What methods should be used?
Section C. How do we know the program is doing good?

Section A will present a wealth of suggestive materials that should help any training director or executive in determining the content of new courses especially in the executive management and supervisory management areas; Section B will present many suggestions as to means to be used in putting over these programs, and Section C will give some very pertinent evaluation suggestions by means of which ratings as to the degree of success of any training program can be determined.

NOTE: (The following report includes the question and answer routines of the conference leader and the group and is followed by composite tables developed for each of the four levels of management and employees that have been mentioned.)

Points to Be Checked in Evaluating a Training Program for Executive Management

(Tabulation showing composite of three conferences.)

Section A. What Materials Should Be Presented in This Program?

*1. Human relations (courtesy, observing channels, etc.)
2. Company policies and company morale
3. Analysis of employee attitudes and opinions
4. Analysis of training programs, objectives, methods, and results
5. Job relations
6. Labor relations and employee welfare
7. Public relations
8. Business ethics
*9. Plant organization and departmental relationships
10. Analysis of executive and supervisory relationships, responsibilities and techniques (what management expects of supervision and vice versa)
11. Labor legislation and its interpretation
12. Labor contracts, negotiation and interpretation
13. Federal and state laws re: manufacturing and company product
*14. Corporation laws and corporation management
15. Executive development, promotion and rating
16. Leadership training
*17. Business and industrial economics
18. Wage structures and wage differentials
19. Cost control

*Noted as especially important by the group.

20. Business statistics
21. Forecasting and new developments
22. Analysis of consumer needs and desires
23. Study allied industries and new developments
24. Analysis of competitors and their products
25. Recognizing and handling suggestions
26. Study of housekeeping, safety, waste elimination
27. Social trends
28. Research methods
29. Conference leading
30. Speaking to groups

Section B. What Methods Should Be Used in This Program?

1. Conference leadership training
2. Conferences led by selected executives, training directors, and outside agencies
3. Group conferences of representative employees
4. Use of outside consultants and experts as needed
5. Speakers from professional and technical organization
6. Use of state board for vocational education, college, and other services
7. Special foreman club meetings
8. Surveys and reports
9. Evaluating committee reports
10. Coaching and counseling by superiors
11. Use of house organs, manuals, bulletins, trade journals, books and texts and visual aids
12. Visitation and observation
13. Multiple management

Section C. How Do We Know That the Program Is Doing Good?

1. Improved attitudes throughout the plant
   a) In executive management group
   b) In supervisory management group
   c) In employee groups
   d) Between all groups.
2. Decreased labor turnover
3. Production records
   a) Cost and profit records
   b) Waste reduction
   c) Safety records
   d) Meeting schedules
4. Grievance and gripe reduction
5. Sampling of opinions
6. Interest and attendance
7. Requests for more training
8. Improved promotion and demotion policies
9. Case studies (before and after)
10. Better satisfied customers

How to Get the Program Started

1. Approach an open-minded executive that you know is interested in training; sell him and have him sell his group
2. Direct sales by educational director
3. Outside consultant approach
4. Co-ordinator group representation approach

Points to Be Checked in Evaluating a Training Program for Supervisory Management

(*Tabulation showing composite of three conferences.*)

Section A. What Materials Should Be Presented in This Program?

**1. Human relations (courtesy and observation of channels)
2. Company morale
**3. Company and departmental policies
4. Job relations, employee relations, employee welfare
5. Public relations
**6. Analysis of executive and supervisory relationships and responsibilities (what do management and supervision expect of each other?)
**7. Company products and uses
**8. Plant organization and procedures
**9. Business economics
10. Business statistics
11. Business ethics
**12. State and federal legislation governing company and product
13. Labor legislation
14. Labor contracts, negotiation and interpretation
**15. Handling complaints and grievances
16. Analysis of training program
17. Instructional techniques
18. Conference leading technique
19. Supervisory skills
20. Leadership training
21. Supervisory rating
**22. Production and quality control
**23. Cost control
24. Good housekeeping
**25. Safety
26. Planning and scheduling
27. Analysis of allied industries and new developments
28. Analysis of competitors and their products
29. Analysis of consumer needs and wants
30. Proper supervisory handling of suggestions
31. Social trends
32. Wage structure and proper differentials

Section B. What Methods Should Be Used in This Program?

1. Training department programs
2. Conference leadership training
3. Conferences led by selected executives, training directors, and other supervisors
4. Outside instructors and experts
5. Lecture-discussion groups
6. Foreman club programs
7. House organ, publications, bulletins, trade magazines, reports
8. Visual aids
9. Special assignment and reports
10. Evaluating committee reports
11. Use of state board for vocational education, college, and other services
12. Interdepartmental forums
13. Plant library
14. Open house
15. Consultant supervision

Section C. How Do We Know That the Program Is Doing Good?

1. Improved attitudes
   a) In the supervisory force
   b) Between supervisory force and workers
   c) Between supervisory force and top management
2. Decreased labor turnover
3. Decreased absenteeism
4. Before and after comparison
   a) Waste
   b) Rejects
   c) Safety, etc.
5. Comments
6. Case studies
7. Fewer complaints and grievances
8. Informal checks by top management
9. Lowered training time
10. Greater loyalty and better morale
11. Higher production at lowered costs
12. Interest and attendance

**Rated as very important by the group.

Points to Be Checked in Evaluating Training Program for Apprentices

(Tabulation showing composite of three conferences.)

Section A. What Materials Should Be Presented in This Program?

1. Skills of the trade (outlined and scheduled)
2. Related training
   a) Math and shop problems
   b) Science of the trade
   c) Blueprint reading and drawing
   d) Product knowledge
3. Company background and policies
4. Human relations
5. Advancement and promotion opportunities
6. Job methods
7. Teaching techniques
8. Business and industrial economics
9. Trade ethics
10. Safety and accident prevention and health information
11. Labor legislation
12. Labor contract and interpretation
13. Employer-employee relations

Section B. What Methods Should Be Used in This Program?

1. Training department program
2. On the job instruction
3. Related class rooms
4. Vestibule schools
5. Vocational schools
6. Conferences
7. Personal counseling
8. Careful placement
9. Textbooks, trade journals, manuals
10. Company handbooks and bulletins
11. Visual aids
12. Supplementary instructional material
13. Setting proper example

Section C. How Do We Know That the Program Is Doing Good?

1. Test results
2. Production results
   a) Quality
   b) Quantity
3. Foreman reports
4. Lesson grades and progress
5. Improved attitudes
   a) Toward company
   b) Toward supervision
   c) Toward other employees
6. Fewer dropouts
7. Fewer complaints and grievances
8. Shortened training time

Points to Be Checked in Evaluating Job Training Program

(Tabulation showing composite of three conferences.)

Section A. What Materials Should be Presented in This Program?

1. Skills of the jobs to be taught (outlined and scheduled)
2. Related training
   a) Math and shop problems
   b) Blueprint reading
   c) Trade information
3. Company background and policies
4. Human relations
5. Business economics and cost analysis
6. Labor contract
7. Employee relationships

Section B. What Methods Should Be Used in This Program?

1. Training department program
2. On the job instruction
3. Vestibule schools
4. Vocational schools
5. Classroom
6. Conferences
7. Personal counseling
8. Careful placement
9. Textbooks, trade journals, manuals
10. Company handbooks and bulletins
11. Visual aids
12. Supplementary instructional material
13. Setting proper example

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6. Fewer dropouts
7. Fewer complaints and grievances
8. Shortened training time

Summary

In the preceding conferences we have developed some very valuable tabulations that may be used in evaluating training programs on four different levels, viz.:

1. Executive management training
2. Supervisory management training
3. Apprentice training
4. Job training.

Each group contains three subheadings:

1. What materials should be presented in this program?
2. What methods should be used in this program?
3. How do we know that the program is doing good?

The subheading "What Materials Should Be Presented in This Program?" presents suggestions of what should be used as content material under each type of program. This enables the educational director to decide as to the completeness and thoroughness of his own work, keeping in mind, of course, his own factory conditions and needs.

The subheading "What Methods Should Be Used in This Program?" gives the educational director an opportunity to check his methods and procedures in a given instruction area with the methods advocated by the group. Again he must, of course, keep in mind the limitations and needs of the situation wherein he works.

The subheading "How Do We Know That the Program Is Doing Good?" outlines definite procedures to be followed in each area to check results of the training offered. It is unlikely that any one trainer or executive will ever have to employ all the techniques suggested; however, the large number presented should prove suggestive and stimulating to any one charged with evaluating procedures. It is hoped that this material will make the matter of rating training programs more objective and satisfactory to all concerned.

Vocational Education and Society

THOMAS DIAMOND
Professor
Vocational Education
University of Michigan
Ann Arbor, Mich.

(Continued from page 13 of the January, 1947, issue)

The Responsibilities of a Director

The superintendent of schools is responsible to the board of education for the complete educational program in his community. When the size of the community warrants it the superintendent recommends for appointment supervisors or directors in special fields who represent him in their field of specialization. By this means certain responsibilities are delegated to others, thus freeing the superintendent for greater activity in areas where his administrative training can function more effectively.

Thus, the director of industrial arts or of vocational education represents the superintendent of schools in all matters within his field of specialization. He is responsible to the superintendent, and, any authority he may have is vested in him by that office.

The diagram shown herewith shows that the principals of all schools report directly to the superintendent as does the director of vocational education. Each principal is responsible for all teachers in his school, including the shop teachers. There is no direct line between the director and the shop teacher so he must work through the principal. In view of this it may be seen that the principal is directly responsible to the superintendent for the success of his school. The director or supervisor represents the superintendent in the position of expert adviser to the principal in matters belonging to his special field.

In carrying out his function as an expert the director has two distinct types of responsibilities. The first of these involves all of those tasks that make possible the carrying on of the program for which he is responsible. These duties are classified under the general heading of *administration.*

The second responsibility involves those duties that make for the better operation and improvement of the program. These are classified under the heading of *supervision.*

Dr. Homer J. Smith distinguishes between the two as follows:[1] "The administrative activities combine to make all things ready for those who would learn or teach. The supervisory activities purport to improve the instructional work. . . ."

Since the duties classified under each of these heads are intended to bring about a close integration between the special field of the director and the rest of the school system they involve contacts with many people, and entail close working relationships with principals, teachers, and supervisors or directors in other fields of education. Because of this the director must know his field thoroughly; he must be tactful; he must have a broad educational vision; and he must have the courage to strive for the achievement of what he believes.

Because of the close relationship between the two types of duties it is difficult at times to differentiate between them. However, there are activities which clearly lie within one or the other area while others may appear to fit into either. Regardless of this, it is important that the director analyze his job in order that he be in a position to apportion his time to the best advantage.

The director as an *administrator* is expected to have a broad knowledge of the accepted philosophy of education prevailing in his school system. He should be familiar with the main objectives of the schools and, in the light of this philosophy and these objectives, he must determine how his special subject will contribute to the desired ends.

Having decided upon what is to be done he has the responsibility of securing through his superintendent, classrooms, equipment, materials, and teachers necessary to do what has to be done. When this has been accomplished he still has the responsibility of using these facilities to the best advantage in achieving his objectives. This latter activity is called *supervision.*

When the director functions as a supervisor he directs his efforts toward helping his teachers to adjust themselves to the teaching environment. He aids them in their selection of projects and methods of teaching. He orients them in regard to the general objectives of the school and how their subject contributes to them. He helps to build up a co-operative relationship between his teachers and their principals as well as between them and the teachers in other subjects in the school. He helps his teachers organize their teaching materials and brings to their attention the latest literature or ideas pertaining to their special subjects.

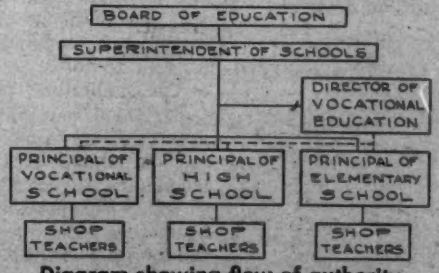

Diagram showing flow of authority

Both of these functions are necessary in any good school system. It is important to have good physical facilities but the value of these facilities from the standpoint of education is determined finally by the intelligence and the effectiveness with which they are used.

Responsibilities of the Director

It has been pointed out that the responsibilities of the director may be administrative or supervisory in character. It has been mentioned also that occasions arise when it becomes difficult to determine under which category an activity should be classified. With this in mind the discussion of these activities which follows is presented with the understanding that no effort is being made to classify them:

The director must decide upon the types of work to be offered through his department.

1. Questions he will have to consider:
   - *a*) Shall it be woodworking, metalworking, printing?
   - *b*) Which sections of the work shall be offered and in which grades shall they be given?
   - *c*) If more than one type of work is offered in which order shall they be given?

2. These questions may be answered in various ways:
   - *a*) The decision may be made upon the basis of what has been done;
   - *b*) It may be based upon the special interest or aptitude of the director in the past;
   - *c*) It may depend upon the equipment or teachers available;
   - *d*) It may be based upon the vocational interests of the community;
   - *e*) It may be decided upon the basis of the contribution the work is likely to make toward the general objectives of the school system.

3. Regardless of the basis upon which the selection of work to be offered is made the director must be able to justify what is being done to his superintendent, to the principals, to the teachers or to other interested groups.

It will be necessary for him to establish a course of study in each field selected.

1. The director may prepare this himself.

2. He may ask each teacher to prepare the course for his special field.

[1] *Industrial Arts in Modern Education,* Bawden and Others, Chap. IV.

3. He may assign the task to a committee of teachers from each field.

4. He may enlist the aid of a committee from the local union as advisers. This committee might work directly with the director or with his teachers. This method is particularly good if the course is intended for students who are preparing to enter a craft.

5. It is important that the course in any field include all that is to be taught in the school system.

a) This total picture must then be assigned to specific grades, semesters, or years. This will tend to establish standards of attainment by subjects and grades.
b) When this is done those concerned with the matter know precisely what is taught and where it is taught.
c) It fixes specific responsibility for each part of the course and minimizes the opportunities for duplication of work in different classes, grades, or schools.

He must decide upon the policies upon which his department will be administered, and he must have them approved by the superintendent.

1. This is necessary in order that his administration operate in harmony with the general policies of the school system.

2. These policies might cover such items as:

a) The ordering of supplies and equipment;
b) How the sale of materials to the students should be handled;
c) The distribution of stock to the various schools.

He is responsible for orienting his teachers in regard to:

1. The policies of the department;
2. Reports to be made;
3. The objectives of the department.

He must prepare a budget in keeping with the course of study and the departmental objectives.

1. Since this budget must be presented to the superintendent, and since he in turn, must justify it before his Board, it is essential that the director be in a position to justify it on the basis of fact.

2. In order that he may have the facts the director must have records of:

a) What has been spent in the past and how the money was distributed.
b) How much material will be needed per pupil for each project.
c) How many supplies will be needed per pupil.
d) The loss or breakage of tools or equipment during the year or years.
e) Changes in enrollment so that he may be able to predict where expansion may be necessary.

3. He must have clearly in mind any change, increase, or reduction in the program.

He must specify and purchase new tools or equipment as they are needed.

1. In this matter the director may rely to some extent on the teachers of the special subjects, but he should be prepared to pass judgment on the following questions:

a) Is the new item justified on the basis of actual need?
b) Is it used in modern industrial practices?
c) Will the new item improve the opportunities for training?
d) Are there other items which should take precedence over this one when spending the money available?

He must plan for adequate publicity in order to promote his department.

1. This means that he must be constantly on the alert to recognize and use opportunities to keep aims, purposes, and achievements of his department before the public.

2. It means also that he must make the necessary contacts in order that he may be able to call upon individuals and organizations to aid in his publicity.

3. This responsibility is extremely important since the extent of the budget assigned to any department in the public schools oftentimes depends upon the extent to which the school authorities and the public agencies understand what is being done in each school department and what it is being done for.

He must select and recommend to the superintendent for appointment new teachers and teachers for replacement.

1. In order that he may be able to do this he must establish the standards upon which his selection shall be made;

2. In doing this he must have in mind the policies of his local school system as well as such state or federal standards as may affect his group;

3. The standards may include such things as age, education, trade experience and teaching experience;

4. In addition to the standard set up the director may consider such things as personality, appearance, speech, recommendations based upon work done in other positions.

He must assign, transfer, and promote teachers.

1. In assigning or transferring teachers the director must work closely with the school principals. It is important that the principal be satisfied with the selection of the teachers who are to be assigned to his school.

2. It is just as important that both principals be consulted about any transfer to be made.

3. The promotion of teachers involves the evaluation of the work done by them on the job.

a) This involves setting up criteria upon which to base the evaluation.
b) It involves also the observation of teachers at work in the classroom.

The director when functioning as a supervisor is responsible for the upgrading of his teachers. This may be done in different ways:

1. The director may have demonstrations of good teaching methods presented to his teachers. He may do this himself or he may arrange to have it done by a teacher who has been using the method successfully.

2. He may make a practice of bringing to the attention of his teachers books or articles from magazines which he feels would be helpful to them.

3. He may arrange to have teachers visit other schools or classes where there are conditions or methods from which they may derive stimulation.

4. He should encourage his teachers to improve their professional standing by taking professional courses, by writing articles for professional magazines, and by taking part in professional meetings.

5. He should develop with them a philosophy of education which recognizes the part their subject plays in attaining the broad objectives of the whole school system.

6. He should follow the practice of talking over with his teachers such departmental problems as affect the teachers. By this means he may bring to his aid the thinking of the whole group.

Conduct Teachers' Meetings

1. These meetings may have two purposes, namely:

a) To inform the teachers concerning matters of policy or procedure;
b) To discuss teaching methods or problems.

2. No meeting should be called unless there is a definite reason for it.

3. A definite agenda should be carefully prepared for each meeting.

a) There should be nothing on the agenda which has no application to the teachers on their jobs.

Rate Teachers

1. If the director is to perform this function, he must have definite characteristics, qualities or achievements upon which to base his judgment.

2. The basis upon which the rating is made should be known to the teacher.

3. It is questionable practice to rate a teacher low on any item unless he has been informed of his weakness and some effort has been made to improve the condition.

4. Teachers should be made aware of their rating and the reasons for it.

5. In some cases self-rating blanks are given to the teachers to be used for self-improvement.

6. When a director is called upon by his superintendent to rate his teachers he should be able to support his judgment on the basis of evidence.

7. If this evidence is to be available when needed, the director should:

a) Observe the teacher at work at frequent intervals;

b) Carefully and accurately record his impression of the teacher and his work;

c) Discuss with the teachers such impressions as affect their grades.

Inspect schools, classes, jobs and products.

1. If desirable standards are set up for the department it is important that the director make periodic inspections with a view to aiding the teachers to maintain them.

2. Inspections should be made in a spirit of helpfulness rather than in one of criticism.

3. The director should strive to build an attitude of co-operation during his inspections. This should lead to his being received with enthusiasm rather than with suspicion.

Make necessary reports.

1. The superintendent should be kept in touch with activities within the department. Since he has assigned the responsibility for the department to the director he expects that he will be kept informed concerning what is being done.

2. In order to receive reimbursement from state or federal funds the superintendent must file certain reports with the state director. The local director is responsible to the superintendent for data included in these reports; consequently, he must be prepared to supply them when asked for.

3. If a report is to be accurate it must be based upon accurate records.

Keep adequate records.

1. Records are necessary to enable the director to speak with authority on matters pertaining to his department.

2. Records should be kept so that they will be intelligible to anyone in the school system who is qualified to interpret them.

3. Records should be accurate and they should be as simple as the nature of the record will permit.

Teachers Evaluate On-The-Job Training for Veterans

BENJAMIN J. NOVAK
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The vocational schools, having served so brilliantly during the war in training many thousands of persons throughout the country for the stupendous production of war materials, are finding even wider fields of service in the postwar period. Their facilities are now equally strained with large numbers of returned veterans who desire to sharpen war-rusted skills or to master new vocations, while receiving financial assistance under Public Law 346. Provision must also be made for young people who are now attending school in greater numbers than during the war years. Evening programs are besieged by veterans, civilians, young and older men and women alike, seeking industrial, household, and avocational skills, or receiving related instruction in conjunction with apprentice training programs.

In addition to performing these within-school services, the vocational schools are being called upon by the Pennsylvania Department of Public Instruction to supply personnel for the important function of evaluating industrial and business establishments offering on-the-job training for veterans. This new duty offers our schools a challenge for discharging wisely a responsibility involving the expenditure of millions of dollars of public funds. The direct industrial contacts involved have many possibilities for developing a closer co-operation between school and the world of employment.

Public Law 346

Under the provisions of Public Law 346, Servicemen's Readjustment Act of 1944, an honorably discharged veteran may learn a trade or other occupation while working on the job. During the training period he receives from the employer the usual scale of wages paid to any beginner in the occupation. The veteran receives also from the Federal Government a subsistence allowance of $65 per month if unmarried, and $90 per month if married or having dependents. When the sum of his wages and subsistence allowance exceeds the standard wage of a journeyman or trained worker in that occupation, exclusive of overtime (or exceeds a given maximum sum which is set by congress), the subsistence allowance is correspondingly reduced. At present the maximum total monthly earning is legally $175 for an unmarried veteran, or $200 for a veteran who is married or has dependents.

The purpose of on-the-job training is to enable the veteran to be self-supporting while mastering some trade skill of his choice. The aim is to offset the effects of actual or potential interruption of training in an occupation incurred by service in the armed forces.

Under the law, each governor was delegated the authority to name an agency for approving veterans' training programs. In a majority of the states the governor assigned the task to the state department of public instruction. In Pennsylvania, the Department of Public Instruction does not refer or place veterans with prospective employers. The veteran may be placed in a job by his own efforts, by a United States Employment Service Agency, or by the Veterans' Administration. The Department of Public Instruction establishes, regulates, and controls standards for the certification of establishments which are training veterans on the job. The purposes of the standards basically are:

1. To protect veterans and taxpaying public from exploitation.

2. To maintain proper educational training standards.

3. To regulate the distribution of trainees in order to prevent an oversupply of workers in certain fields.

4. To assure a reasonable level of employability at the conclusion of the training program.

5. To co-ordinate instructional and labor standards of training agencies, i.e., firms, industrial, and professional organizations.

6. To maintain wage standards to conform with state and federal laws, bargaining agreements, good business practice, and ideals of adequacy.

Inspection and Evaluation

The G.I. Bill in its original form did not provide funds for the inspection and evaluation by the states of firms applying for approval for on-the-job training of veterans. Vocational school co-ordinators were asked to devote part of their time to this function, sending their recommendations to the state department of instruction. This staff being inadequate, the part-time efforts of employees of the United States Employment Service were added.

By the summer of 1946, the applications were far too numerous to be handled, and the Pennsylvania Department of Public Instruction allocated a sum of money for the employment of a staff of investigators during the summer months and thereafter. In Philadelphia, these agents consisted of vocational school co-ordinators and instructors, and teachers of industrial subjects in the high schools. After receiving preliminary instruction, the teachers went out on what proved to be as rich and valuable a series of experiences as can be encountered.

In order that the establishment may receive an inspectional visit by the representative of the Department of Public Instruction, the employer makes application to the area chairman, who is a local director of vocational education. The agent of the Department of Instruction acquaints the employer with on-the-job training standards. These include:

1. Constant supervision of the trainee by a skilled foreman or supervisor.
2. Establishment must offer reasonable assurance of employment to the trainee at the completion of the training program.
3. The ratio of journeymen to trainees should be in accord with employment opportunities or estimates set by the State Apprentice Training Council, union contracts, or accepted standards within an industry.
4. Program should be organized and carried out in such a manner as to give the trainee the opportunity to master all the necessary knowledge and skills required by the occupation.
5. A tentative schedule of wage increases is drawn up coinciding with the trainee's expected growth in occupational skill.
6. A schedule of instruction in work processes is organized, in which the approximate time to be spent on each phase of the work is estimated.

Drafting the Training Program

Following the inspection of the firm's facilities and the drafting of a proposed training program based upon the preceding points, the agent of the department of instruction sends his report, containing his recommendation for approval to Harrisburg, where his findings are reviewed in the Division of Training Facilities for Veterans. The firm is notified officially from Harrisburg of its approval.

The veteran meanwhile applies at the Veterans' Administration for an evaluation of his eligibility for educational benefits under Public Law 346. A veteran with 90 days or more of active service after September 16, 1940, is entitled to one year of training or education, plus an additional amount of time equal to the length of his service. The maximum total time provided in the veteran's certificate of eligibility or entitlement is 48 months.

The Veterans Administration supervises the program drawn up and approved by the agent of the department of instruction. A Veterans Administration representative calls upon the firm periodically, and the firm submits to the Veterans Administration a monthly report of each trainee's attendance, wages, and progress. Veterans receiving a pension for disabilities, and who are in need of vocational rehabilitation, may receive on-the-job subsistence benefits under Public Law 16. Activities under Public Law 16 are the entire responsibility of the Veterans Administration.

Armed with these preliminaries, the agent sets out to visit the employer. Almost every experience and learning ever acquired by the inspector may be called upon in analyzing the training situation which may vary from slaughterhouse butcher to designer of church interiors, with such a variety of other occupations as to cause wonderment and a renewed interest in the ponderous *Dictionary of Occupational Titles*. It is attempted to classify the requests for approval, assigning them to agents on the basis of their respective experience and training. Great personal tact is essential to persuade the employer to gracious acceptance of tentative wage schedules, preparing a training outline, making monthly reports, and reception of periodic visits by Veterans Administration representatives.

On-the-Job Training and Apprentice Training

Occupations offering training on the job are classified into two main groups.

1. *On the job training.* This includes training which may vary in length from three months to a usual maximum of two years, depending upon the occupation. Examples which might be cited in this group are bookkeeper, clerk, salesman, manager, multigraph operator, florist, research assistant, lathe hand, sewing machine operator, editor, and copy writer.

2. *Apprentice training.* This term includes trades requiring a training period of two years or more, conforming to nationally recognized standards. In Pennsylvania, approvals by the State Department of Public Instruction for apprenticeable trades are subject to review by field agents of the Pennsylvania Apprenticeship Council.

This latter service lists at present some 180 apprenticeable trades in Pennsylvania. Some, such as structural ironworker, have a two-year program. Others call for a three-, four-, five-, six-, or even a seven-year period. No veteran, of course, is eligible for more than four years of federal benefits. Each apprentice is required to undertake 144 hours per year of related classroom instruction, including trade theory, drawing, supplementary shop instruction, or other instruction necessary for job proficiency. Other standards are:

1. A progressively increasing scale of wages, averaging over the apprenticeship period not less than 50 per cent of the prevailing journeyman rate.
2. The ratio of journeyman to apprentices shall generally be five to one. Specific industries or labor management agreement, however, may set up some other ratio.

In a program which has been organized

Students of drafting

so recently and which embraces so large and complicated a series of situations, it is remarkable that it is developing with so relatively few difficulties. The entire undertaking is so new, however, that only the broad outlines of its future growth and influence can be sketched. There can be no reservation, however, in predicting that its effect will be important and far reaching.

The instructor serving as an inspector is, of course, not selling his school or intruding his immediate school associations. In his capacity as representative of the State Department of Instruction, however, he suggests schools and courses for the required 144 hours of related instruction needed by apprentices. While inspecting facilities, he cannot help noting methods, equipment, and processes which may be new to him, even though he had fondly hoped that he had been keeping up-to-date in his field. Veterans on an employer and supervisory level are bringing back to original civilian production astonishing war-learned efficiency and initiative. In a similar way, courageous ex-war-production workers are introducing short cuts and radical innovations in design and fabrication in many fields, of a sort that strike the experienced inspector with renewed admiration of the powers of human ingenuity. He also has the opportunity to be a front line spectator of many infant businesses, many of which are so promising that even a casual estimate must be very optimistic of success. Often a number of establishments of the same general type are inspected; thus the inspector can make firsthand comparisons. It is remarkable how great the contrasts that can exist in cheerfulness of surroundings, salaries, employer-employee relation, and equipment. Many business enterprises are vigorous, confident, and forward moving. Others, while being successful, seem stagnant and uninspired.

Contacts With Employers

The inspectional duties afford constant contact with a variety of employers, and less directly with veterans. The composite picture of the average employer would depict a person of intelligence, courtesy, breadth of view, patience, and honesty. A few, to be sure, display prejudices, rudeness, and a desire to get inexpensive labor, or the aim to take advantage of the taxpayer. An overwhelming majority, however, are earnestly desirous of going far out of their way to train veterans. Most are conscientious in their training, and in submitting the necessary progress reports. In salaries many are voluntarily most generous. The majority treat the veteran as the earnest adult which he generally is, and do much to expedite his progress. The teacher serving as an inspector representing the state feels first a responsibility, but more strongly, a pride in maintaining the honesty and dignity of the state. The inspectors are encouraged to find a prevailing earnestness and honesty in the general carrying out of the programs, disgruntled and vigorous contrary minority reports notwithstanding. The result is a renewed faith that the employers and veterans are predominantly interested in the opportunity for development offered in the program, rather than its exploitation.

The Pennsylvania apprenticeship council, labor unions, and various employer groups are doing a noteworthy work in setting up suitable standards for many trades. This task is not easy, but one important continuing outcome is a closer contact, and inevitably, understanding, between employer and labor groups.

The teacher returning to his instruction after such experiences finds himself refreshed and broadened in his understanding of industrial processes and techniques. He knows better the entire labor scene, from the point of view of employer and worker groups and individuals. His ability to discharge the function of placing his students is certain to become more easy and efficient.

He finally realizes that, whether or not he was conscious of the process, he has widened his industrial contacts and made many friends for public education.

More Students for Co-operative Programs

DONALD K. BECKLEY

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Prince School of Retailing
Boston, Mass.

In a recent article in this magazine,[1] the need for more publicity for co-operative programs was stressed, and several methods of securing publicity were mentioned. It is the purpose of this article to describe in more detail several publicity techniques which have been used to make employers, parents, and prospective students interested in enrolling in co-operative programs.

The current trend toward large enrollments in schools and colleges provides co-operative programs with a unique opportunity. In most cases there is no longer need to seek new students merely to keep the program going, as was true in some cases during the war; the concern now is for more applicants so that the standards of admission can be raised, because larger groups are available from which to make a selection. The higher the standards of co-operative programs in vocational schools, the more readily acceptable their students and graduates will be as employees.

In that which follows, several examples of effective publicity campaigns that have been conducted recently, will be described. The techniques used can be equally effective in other vocational areas.

Syracuse, New York

The personnel directors of six local department stores and the co-ordinator of distributive education in Syracuse arranged a dinner to which high school counselors and administrators were invited. The Beckley theme, "Why Be Afraid of Retailing?" was used as the basis for a brochure. This was presented to each counselor, and in it were listed some of the pertinent facts about retailing along with a complete list of jobs in each of the divisions of retailing. An additional feature was the inclusion of the minimum and maximum wages paid for each of these jobs by local stores. Retail executives at the meeting talked briefly about job opportunities in the field.

There is the possibility that a less negative approach which did not include the idea of being *afraid of retailing* might have been more desirable psychologically. The facts are, however, that the campaign was highly successful. Harold L. Burdick, co-ordinator of distributive education, Syracuse Public Schools, reports that the stores are planning on further meetings and store tours which would give guidance counselors and principals a better idea of the many different jobs in retailing. Store interest in activities of this nature are indicated by the fact that requests for the brochure just mentioned have been received from stores located in 37 states, Hawaii, and Australia.

Mr. Burdick makes it a practice to explain the high school merchandising program to ninth graders in the spring just before they plan their senior high schedules — a critical time in vocational selection.

A further development is the use by Syracuse stores of a mimeographed *throw-*

[1] Donald K. Beckley, "Co-operative Education Needs Publicity," Industrial Arts and Vocational Education, April, 1946, pp. 167–168.

away furnished them by the schools, and used at the end of the vacation period to urge students working in the store to enroll in retailing courses. It is worded as follows: *Have You Looked Into This? You Can Earn As You Learn and Have School Credit.* It is then suggested that the student arrange his schedule so that he can work part time, and he is advised to consult his school authorities for details.

Columbus, Ohio

A meeting of store owners and top management together with high school principals and counselors paved the way for a second dinner meeting of personnel directors and school people. From these two meetings and from data from other cities, an illustrated pamphlet entitled *Retailing as a Career* was developed. Designed to attract the interest of high school students to retailing, these pamphlets were distributed to all graduates by the schools themselves. In addition to a listing of the jobs in retailing, the advantages of the field are briefly stated. It is the opinion of Pierre D. Hale, manager of the Retail Merchants Association, that this publicity material has already paid for itself. Mr. Hale stated that the pamphlet has performed a service not originally contemplated: it helps in the vocational counselors' work with the students. It may well have been that in many cases the counselors were themselves none too familiar with the possibilities of retailing as a career, and the pamphlet provided some of the answers.

Pittsburgh, Pa.

In Pittsburgh, the collaboration of the school authorities and a group of local stores resulted in the publication of a pamphlet entitled *There is a Future for You in Retailing.* This booklet was prepared by the research bureau for retail training, University of Pittsburgh, and it dramatizes the importance of retailing as a leading industry. On the back page of this booklet is the suggestion: "Talk it over with your family. . . . And here's a warm personal invitation to come in now and discuss your future in retailing with the employment managers of the following Pittsburgh stores." Here were listed the eight participating department stores.

Publicity in Your Own Community

Steps such as those outlined have been carried out in many other cities as well, and can be used as models for campaigns in your own community. One essential procedure is the publication of some sort of an attractive, illustrated booklet or folder for distribution to high school and possibly junior high school students. Retailing and other vocations can be portrayed as colorful and interesting fields of work, but we need more than word pictures to make young people visualize these aspects of the job.

It seems clear that vocational education cannot be properly effective without publicity, and the kinds of publicity which are the result of co-operation among the various interested agencies in the community seem best calculated to secure the results desired.

Psychiatry Helps Workers in Industry

DR. WALDEMAR SCHWEISHEIMER
Lowell, Mass.

Industrial psychiatry is a new but rapidly growing field. It has three main fields — they are teaching, clinical practice, and research. D. Ewen Cameron, in an extensive study in the *Canadian Medical Association Journal*, states that the vast amount of mental ill-health and the beginning of behavioral breakdown is not recognized for what it is. We can already identify certain trades which are dangerous to certain people. For almost all people the repetitive inspection of one small part, or the endless performance of one limited operation may be harmful. For instance, one woman pasted a strip of paper on 18,000 paper bags every day.

Today we recognize, Ewesen points out, that if we overload the man who is excessively set upon doing his job well, who cannot be content unless it is just so, we shall find that he begins to develop tension and anxiety. He will lose confidence and concentration and will eventually have to drop his work.

Working Longer and Longer Hours

People, of course, are different. Ewen relates the case of a clerk who had to do more and more work when several other clerks had been drafted. He was not able to relax his standards; to have done so, would have in itself, with this personality, created anxiety. Accordingly, he worked longer and longer hours and kept himself under continuing rising pressure in a vain attempt to check and supervise everything. The result was that he ultimately broke down into a state of anxiety and at the end of two years was still unable to return to work.

We all know from experience that this experience cannot be generalized. Some people can well stand more responsibility and longer hours. But it is just the task of industrial psychiatry and psychology to find out people who suffer harm by such development. Rising tension may manifest itself in such conditions as blurring of vision, dizziness, itching of the skin, noises in the ears — all symptoms which, heretofore, were believed to be mostly of physical origin.

A study by L. S. Kubie comes to the conclusion that psychiatry can be of value to industry in the following manner: (1) screening out those workers who are totally unemployable and providing for their shelter, care, and treatment; (2) allocating to specially chosen tasks, or to sheltered workshops those who can remain well only under special working conditions; (3) evaluating individuals both as to their special technical aptitudes and as to their special personality quirks, and allocating them to jobs which fit both special conditions; (4) applying therapeutic principles to the individual worker who is maladjusted; (5) using social service procedures to assist workers in coping with those out-of-plant problems which affect both their total psychological adjustment and their plant efficiency; (6) studying the incidence of neurotic disturbances in different types of work and under different working conditions; and (7) comparing the efficiency of different systems of job training and the like.

Out-of-Plant Problems and Plant Efficiency

Bela Mittelmann and associates in a study of psycomatic disorders of industrial personnel give some excellent examples how out-of-plant problems influence industrial efficiency. A 35-year-old man, who was one of the best mechanics in his section, complained that the noise bothered him and the light irritated his eyes. He also complained of palpitation of the heart, excessive perspiration, and stomach distress. He had been working in the same department for two years; there was no previous difficulty.

He had always been anxious and worrisome. His wife was seven months pregnant and he had been worrying that she might die in childbirth in spite of the fact that,

according to physical examination, his wife was healthy. She herself had no such worries. He was reassured by the plant physician and referred for further interviews to a psychiatrist whom he visited five times at weekly intervals. He gained insight into his day-to-day reactions to stress, and into the origin of his disturbances. Consequently, he worried less about his wife and lost his sensitivity to noise and light.

In another case described by Mittelmann and associates, a man with an anxiety state failed in his job because of his noisy environment. He succeeded after he was placed in quieter surroundings which were more compatible with his personality.

A woman worker was afraid her marriage would fail; she started making errors in her work. Brief psychotherapy relieved her symptoms and restored her working efficiency.

Do's and Don'ts

E. A. Irvin, medical director, Cadillac Motor Car Division, Detroit, has published his experiences with psychosomatic (concerning body and mind) consultations in industry. For handling the problems he has developed some "Do's" and "Don'ts" some of which are mentioned here. Recognize "physical ills" and "emotional problems" and how much of one and how much of the other, remembering that each has an effect on the progress of the other. See the *whole man* and you will see the whole picture. Do the examination and interview in complete privacy. No patient likes to talk confidentially in an atmosphere which makes him feel that he is being overheard. Whenever possible have advance information about the patient. This can easily be done with patients referred to the doctor by the foreman, or the employment or personnel department. It is possible to have a few pertinent facts about the person, such as work record, known trouble with the job, or any other information which may assist with the examination.

Here are some Don'ts mentioned by Dr. Irvin. Don't hurry the patient; avoid interrupting him until he has had an opportunity to give his story in full, and to explain the problem as he sees it. Don't pry into personal affairs. Don't challenge a patient's statement even though it may be an untruth. This may cause him to become angry or to *close up*. Silence on the doctor's part is apt to draw out the other person, though too much silence can become burdensome. Don't disclose information obtained confidentially. This is particularly important in industry.

Prevention and Treatment

Dr. J. L. Fetterman, director, neuropsychiatric Institute, Cleveland, Ohio, in a study on neuropsychiatric aspects of industrial accidents, gives some hints on prevention and treatment of such man-made accidents. Favorable working conditions in the plant are imperative, particularly from the standpoint of lessening resentment and relieving nervous tension. Fatigue will increase the accident rate; Smith reported in one study that accidents were 2½ times as frequent when a 12-hour day was being worked as when the working day was reduced to 10 hours. The occurrence of an accident should invite a discussion of the relationship of the person to the particular task before him. Accident-prone individuals should be assigned to jobs where there is less accident liability.

It should be good business as well as good public health, Fetterman says, for employers to engage psychologists on their staffs. Tests of co-ordination are being developed by psychologists which may become practical and enable a selection of individuals for particular jobs. Disorders of the brain, disturbances of consciousness, diseases of the spinal cord lead to unsteadiness, inattention, lapses, which also result in accidents.

Designing Must Be a Co-operative Venture

G. HAROLD BILLINGHAM
Weehawken, N. J.

Interplant friction hurts somebody, so we stress harmony between labor and management, production and inspection, and interdepartment dovetailing in general.

Too little attention is given to the necessity for a generous spirit of co-operation between the designer and the middle men that are involved before the product is actually available to the consumer.

Between the two extremes there are many complaints which cannot be justified, either by those who make them, or by those responsible for the condition.

Information Withheld

In most cases the designer is not notified of a factor which has caused difficulties, perhaps avoidable, in another department or plant. He did not counsel with specialists while giving attention to the design, and due to other commitments is unable to follow it up.

Too often the other fellow's side of the picture is not considered, although he, too, has a part in the creation of a product.

Some of the unrest in industry is thus due to a lack of appreciation of the work of others.

Although the meaning of design in industry has changed greatly, it still involves men, money, and materials. The man on the street is being educated to think of it in terms of "streamlining" but it is more than visual for this modern, highly competitive age.

Methods of mass production, simplifying jobs, eliminating whole sections of plants in some cases, may mean danger ahead.

The sewing machine is a good example to use as an illustration. Housing problems caused a need for a machine that could be kept on a closet shelf or used as furniture. Redesigning did away with the conventional cast iron legs, and the foundry lost another repeat business account.

Die casting is producing a product with a fine finish at production rates and cost. The sand foundry, therefore, is becoming cost conscious, and is finding that the trade is demanding clean, sound castings, at a predetermined cost. The field of nondestructive testing has expanded to aid in the examination of the product before expensive tool processes are started.

Scrapping Work Is Expensive

Scrap from dry sand molding is usually in large chunks, expensive to salvage for reworking. Many of the rejects can definitely be attributed to *faulty design*. This may simply mean lack of foundry engineering practices knowledge. A good foundryman knows that wearing surfaces should be cast down, based on actual experiences, and can help with the placing of supporting members to insure maximum yield. Minor points to the designer may be a problem to the shop.

The foundry art, practiced before the Christian era, and handed down from father to son, is meeting a challenge. No attempt was previously made to keep accurate records, particularly in plant foundries which only produced castings for a single plant.

However, the foundryman, aided by research made by engineers who make studies of production time, costs, mechanical short cuts, chemical aids, safety, and

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Industrial Arts and Vocational Education
John J. Metz, Editor

ANOTHER OF AMERICA'S GREAT SONS

The month of February truly may be called the month of famous men. Among those who claim February as the month of their birth there is probably none greater, at least in the fields of science and invention, than Thomas Alva Edison, who was born at Milan, Ohio, February 11, 1847.

This year, then, marks the centenary of his birth, and it is well for every student of industrial arts and vocational education to pause a few moments to contemplate the accomplishments of this great man. Of course, his span of life was eighty-four years, yet he achieved so much during those years that one can say his life was crowded with purposeful activity which affected the lives of every man, woman, and child not only in our own country, but in every place in the world that can lay any claim to civilization.

Edison showed a keen interest in chemistry at a very early age. It is said that when he was ten he had a laboratory in which he was experimenting with chemicals in the basement of his parents' home at Port Huron, Mich.

When he was twelve he got a job as newsboy and "candy butcher" on the Grand Trunk Railway, running between Port Huron and Detroit.

Three years later he started publishing a small newspaper, *The Weekly Herald*, which he set up, printed, and then sold on the train making the run from Port Huron to Detroit.

In August, 1862, he was instrumental in saving the life of a young boy whose father was station agent at Mt. Clemens, Mich. In gratitude the father, J. U. Mackenzie, taught Edison telegraphy. Two years later he put up a telegraph line leading from the Port Huron railway station to the village and then worked in the local office. In a very short while he was appointed telegraph operator on the Grand Trunk Railway at Stratford Junction, Ontario, Canada. When the telegraph cable across the river between Sarnia, Ontario, and Port Huron broke, he quickly used a locomotive whistle to telegraph messages across between these two towns.

In 1868 he made his first patented invention, an electric vote recorder. This was followed in the next year by the invention of the "Universal" stock ticker, and the "Unison," a device for synchronizing all stock tickers on a given circuit. In 1870 the Gold and Stock Telegraph Company paid Edison $40,000 for his stock ticker. In 1871 he helped Christopher L. Sholes, the inventor of the typewriter, make the first successful working model of his machine.

During the next four years he manufactured numerous telegraph instruments for the Western Union Telegraph Company and Automatic Telegraph Company. Besides this he completed many other inventions, including the motograph, and several automatic telegraph systems, such as the duplex, quadruplex, sextuplex, and multiplex systems. He also invented paraffin paper and the carbon rheostat during this period.

In 1873 he went to London to demonstrate the use of his automatic telegraph over long circuits and submarine cables. As early as 1875 he discovered what he called "etheric force" which twelve years later was recognized as being due to electric waves in free space. This discovery is really the foundation of wireless telegraphy.

Edison established what is probably the first laboratory for organized industrial research at Menlo Park, N. J., in 1876. Then followed his invention of the phonograph, the carbon telephone transmitter, and the microtasimeter for indicating minute heat variations.

On October 24, 1878, he incorporated the Edison Electric Light Company and in 1879 he invented the first practical incandescent electric lamp. In the same year he invented improvements in the construction of generators for light, heat, and power transmission, and soon after gave demonstrations of electric lighting systems in streets and buildings at Menlo Park.

On May 13, 1880, he started operation of the first passenger electric railway in this country at Menlo Park, N. J. The year 1880 also saw the magnetic ore separator which he had invented, and the organization of the Edison Lamp Works at Menlo Park. In 1882 he opened the first commercial incandescent lighting and power station at Holborn Viaduct, London, England. The first commercial central station for incandescent lighting in this country was opened at New York City on September 4, 1882.

In 1885 he patented a system for communicating by means of wireless induction telegraphy between railway stations and moving trains.

During the first four years at his West Orange laboratory, opened November 24, 1887, he took out over eighty patents on improvements on the cylinder phonograph, and established an extensive business in the manufacture and sale of phonographs, records, dictating machines, and shavable records.

On October 6, 1889, he showed the first experimental motion picture, a "talkie," at the West Orange laboratory, and on July 31, 1891, he applied for a patent on a motion picture camera. The first commercial showing of a motion picture was made in New York City, April 14, 1894.

In 1896 Edison developed the fluoroscope, but he did not patent it because its need in medicine and surgery prompted him to leave it to the public, untrammeled by patent rights.

He had also made extensive studies on primary and storage batteries. The culmination of this work brought about the invention of the Edison nickel-iron-alkaline storage battery much used as a power source in mine and plant transportation, lighting, signaling, and similar services.

Early in the eighties, Edison had experimented considerably with processes of iron-ore concentration. By 1891 he had perfected methods so that he could erect a large plant at Edison, N. J. This work greatly helped him when he entered the cement industry and constructed the Edison cement plant at New Village, N. J., in 1901. He also invented a long rotary kiln for cement production.

In 1907 he developed a universal electric motor, running on either alternating or direct current electricity for driving dictating machines and other similar small devices. From 1910 to 1914 he spent his time on improving the disk phonograph, produced the kinetophone for talking motion pictures, invented an electric safety lantern for miners, developed a process for making synthetic carbolic acid and designed a plant which produced a ton a day of this widely used anesthetic which was much in demand at the time because of World War I. He invented the telescribe, an instrument which permitted the recording of both sides of a telephone message, and established plants for producing coal-tar derivatives which industry had previously obtained largely from Europe. These coal-tar products were desperately needed for making wartime ammunition and explosives.

In 1915 he was made president of the Naval Consulting Board. In 1923 he made a study of economic conditions which was published in 1924. He received the Congressional Medal of Honor on October 20, 1928.

When stricken with his final illness, he was investigating the possibility of growing rubber in the United States and had the satisfaction of seeing and handling a small piece of rubber made from goldenrod grown in his experimental gardens at Fort Myers, Florida.

He died at Llewellyn Park, West Orange, N. J., at the age of eighty-four, on October 18, 1931. Edison's life sets a fine example for every American boy. He was always busy at something. He had no time to waste and he possessed great perseverance. The fruit of his labors made him wealthy, but they also made every living person richer because of what they accomplished in the way of raising the living standards not only in this country but all over the civilized world.

(Continued from page 54)

the like, realizes that he must co-operate in order that his plant may survive.

We are in an era of exploiting new, useful, workable metals, automatic devices, and machines. Many new ideas in engineering and production methods are needed. The man at the bench or machine may have the key to some of the problems through his experiences with poorly designed units.

Timesaving Equipment Must Be Understood

You may design and have installed on a machine a workable time saving device. Will the worker continue to use it, and has the problem of maintenance, including adjustment, been taken care of? The foreman perhaps was not approached on the idea, is not sold on it, and bothered with labor turnover and other problems, may not instruct operators in its use and maintenance. The result could be to the designer's disadvantage.

Too often we hear complaints regarding a fixture that is too heavy or awkward to handle, install, or store. Its ability to do the job accurately and efficiently is overshadowed by lack of practical machine problem knowledge on the part of the designer.

The limitations of specific shop equipment must be kept in mind as another means of promoting and maintaining harmony. A few friendly words with the foreman or experienced operators may disclose another angle, and simplify the entire unit. Lack of information may be costly in time, labor, and material. Knowledge is power! Active and accurate co-operation cannot be overemphasized.

Many accessories are mislaid, or lost, because built-in storage space was not provided. Human failure has not been given enough consideration in this matter although the problem in many cases could be solved by a visit with specialists in the shop.

Switch location, the type necessary for capacity, safety, ease of operation, and consideration of operator fatigue can be best determined by practical application study. There are too many engineering revisions. These can mean the improvement or redesign of machines, equipment, or processes, so as not merely to cover up hazards, but to eliminate them and at the same time increase efficiency and production. Motion study should be charted, with a fair degree of accuracy, before starting manufacture, not afterward. The elimination of fatigue should be given primary consideration.

Design Determination Must Also Include the Consumer

Sales departments sometimes determine design. The extent to which they are consulted should be based on a sound knowledge of facts involved, not the competitive market surface. Cost is nearly always a factor and close co-operation of those involved in producing the unit can give positive results.

Consider your design from the viewpoint of those using it, not selling it.

Short life, high repair costs, quick depreciation and low resale values are sometimes written off under design failure.

Good will can be built into a carefully designed product. The most discriminating buyers are those who purchase for home or small shop use.

The newcomer in the field of design must profit by the experiences of others. Instead of keeping his fingers crossed, he should visit the plant. A sound knowledge of his subject, ability to see the viewpoint of others, and to be a good judge of human nature, are desirable characteristics for a designer. Give consideration to the one who is to do the job on cutting corners, before cutting them!

Remember that shop tradition may get you both into and out of trouble.

Testing and Tests

TEST FORMS FOR USE IN VOCATIONAL EDUCATION

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In a previous article[1] it was pointed out that the test forms to be used in constructing achievement tests should be selected only after the specific course objectives have been decided upon and the material to be measured has been determined. This article has been written to describe and to illustrate several of the many test forms suitable for use in vocational education.

[1]Beckley and Smith, "Constructing Achievement Tests for Practical Use," page 52, February, 1945, issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION.

An objective of many courses is acquisition of information — the student should have a knowledge of the important terms, facts, and principles taught in the course. In planning a test to measure the extent to which students have succeeded in attaining this objective, the question of what facts, terms, and principles are really important must be considered carefully. Too often test items are built on information of minor significance, and some of the essential material is overlooked. The problem is also to construct test situations which require the student to think, rather than to write down information he has memorized from textbooks or teachers' lectures.

The Completion Exercise

The simplest and most easily constructed test form for use in measuring knowledge of information is the completion exercise. This consists of a question followed by a space for the answer, or an incomplete statement for which the correct completion is to be written. For example:

1. The part of the automobile which reduces the noise of the exhaust is a.....
2. A meter is equal to.....inches.
3. The symbol for silver is.....

This type of exercise is useful where the answer is to be expressed as a number, symbol, word, or simple phrase. When there are a number of possible correct answers, or when the correct answer is longer than two or three words, this test form becomes less effective, and problems arise in the scoring. It is important that the correct answer is not given away by the grammatical construction of the sentence.

In preparing items for completion exercises, care must be taken that the student understands the kind of response desired. For example:

1. Benjamin Franklin was famous for his..... does not indicate whether the teacher expects the student to mention Franklin's experiments in electricity, his writing of *Poor Richard's Almanac*, his qualities as ambassador, or some one of the many other activities for which he was noted.

The True-False Statement

Most teachers have used the type of test statements which the students are to indicate as either true or false. These state-

ments can be prepared very readily, and this fact often results in their being constructed poorly. Too frequently true-false statements are made by merely taking sentences out of a textbook and making some of them negative. While a wide sampling of material can be covered through the use of this test form, the items are likely to show whether or not the student has memorized the text material rather than whether or not he actually understands it.

The principal difficulty in the use of true-false statements is the likelihood of ambiguity — that a statement can be interpreted as being both true and false. In many courses it is quite difficult to construct suitable items which are not ambiguous and at the same time are not too easy to be usable. Often the reaction of a student will be different from that of the instructor, and the interpretations of what the item means may vary substantially. This difficulty increases as the statements become longer and grammatically more involved. As generally interpreted, a true-false statement is false if any part of it is incorrect. It is not considered to be good testing procedure to have the emphasized part of the statement correct, while a relatively unimportant phrase is false, thus making the statement false. The results of tests composed of items of this sort will be more likely to show a student's skill in answering tests than his actual knowledge of the material.

Another limitation in the use of true-false statements is that chance plays so large a part in determing a student's score. There is always a temptation to guess at the answers, and there is a 50-50 chance that the guess will be right, even though the student may know nothing about the material. This fact has led to the wide use of a scoring system in which the net score is computed as the number right minus the number wrong. Under this plan, students are discouraged from blind guessing by a penalty for wrong answers. It seems unlikely, however, that guessing can be eliminated, and there is serious doubt as to whether this more involved scoring system provides any more accurate a picture of a student's knowledge than the simpler plan of totaling the correct responses.

The true-false statement is not as widely used today as formerly in the standardized achievement tests, but it is still well adapted for use in testing for the existence of popular misconceptions, or in items where there are only two possible answers.

There is an adaptation of the true-false statement which is especially useful in providing material for review purposes. In this form, the student is instructed to mark each statement "True" if it is correct as stated. If it is incorrect, the student is to change the wording so that it is correct. Thus, to answer these items correctly, the student must not only distinguish between true and false statements, but in addition must know what, if anything, is wrong. Particular care must be taken in constructing these items so that the false statements can be corrected without necessitating the complete rewriting of the sentence. However, students should not be permitted to correct the false statements merely by changing the verb from positive to negative, or vice versa. For example:

Directions: This is a true and false examination which is different from most of those which you have been accustomed to taking. In the following statements you are to write the word "True" after those statements which you believe to be correct. However, in the case of those which are incorrect, you are to write the word *false*, and immediately following this you are to make the statement correct by altering the predicate. You will not be given credit for inserting the word *no* or *not;* but must make the necessary corrections by rewriting the incorrect part of the statement. Thus:

1. The instrument which is most commonly used to measure cylindrical pieces in the machine shop to an accuracy of one one-thousandth of an inch is the micrometer. ....True.....

2. The part which is generally used to hold a piece of work on a lathe when no tailstock is used is called a dog.....False ....chuck.....

A good method to score items of this sort is to give half credit if a student marks an incorrect statement *false* but does not make the proper correction — indicating that he knows it is wrong even though unable to correct it. Then full credit is given to the student who marks an incorrect statement false and makes the proper correction. Of course, there will be no occasion to allow half credit on the correct statements, since they will be answered either right or wrong.

The Multiple-Choice Exercise

The test form which has the greatest possibilities for test use is the multiple-choice exercise. It can be adapted for use in testing for a wide variety of objectives, and is particularly suitable for measuring knowledge of information. In its most common form, this test form consists of a direct question or an incomplete statement followed by several responses, only one of which is correct. For example:

1. The plates of the ordinary automobile storage battery are made of a (1) steel alloy.....; (2) zinc alloy.....; (3) lead alloy.....; (4) nickel alloy.....; (5) iron alloy..... These items can be set up so that the student indicates the correct response by placing a mark in a space next to it, as in the foregoing example, or by writing the letter or number of the correct response in a space provided. This latter form can be scored more readily if the answer spaces are arranged in columns.

One of the features of the multiple-choice exercise is that various degrees of discrimination can be measured. In other words, it is possible to determine a student's knowledge of a particular point at several levels of difficulty, and from a number of approaches. Lindquist[2] has given an excellent illustration of this using Ohm's Law as an example. The following test items were given to more than 300 students with the following interesting results. They were first instructed to:

a) Write the formula for Ohm's Law, using letters only. This was correctly answered by 87 per cent of the students. However, when the following multiple-choice form was utilized:

b) Which of the following is the correct formula for Ohm's Law? (1) $I=\frac{R}{E}$; (2) $R=\frac{E}{I}$; (3) $I=R\times E$; (4) $E=\frac{R}{I}$.

Sixty per cent of the students answered this correctly. When they were asked to make the following application of the law, only 36 per cent answered it correctly:

c) What causes the fuse in a house lighting socket to burn out if the two terminals in the light socket come into direct contact with each other? (1) The fuse is burned out by the sparks that form in the socket. (2) The closed circuit has a very low resistance. (3) Heat produced in the socket makes the fuse burn out. (4) The closed circuit gets hot because it has a very high resistance. It is apparent that in item (*a*) the students had learned the formula by rote, and when confronted with the formula in a slightly different form as in (*b*) they were not able to do as well. The simple application of Ohm's Law as measured by item (*c*) revealed that only slightly over one-third of the students had the ability to interpret the real significance of the law.

A frequent weakness in the preparation of multiple-choice items is the inclusion in the correct response of clues which will identify it without more than a superficial knowledge of the subject. In this connection, textbook language should be avoided as much as possible in phrasing the correct responses, so that the student will be required to think. Care should be taken that the correct answer is not consistently longer or shorter than the incorrect ones, and that all responses are grammatically consistent with the question or the statement used.

A difficulty in the construction of these items is avoiding ambiguity and at the same time making all of the alternate responses plausible. A multiple-choice item loses its effectiveness if the incorrect answers do not require some thought by the students. If there are only two responses that are at all plausible or possible, it is

[2] H. E. Hawkes, E. F. Lindquist, and C. R. Mann — *The Construction and Use of Achievement Examinations*, pp. 93–94 (Boston: Houghton, Mifflin Co., 1936).

ordinarily better to use a true-false or completion item.

While multiple-choice items most commonly call for the student to select the one correct response, there are variations which are preferable in some types of test. Items may be constructed with more than one response correct, and the student instructed to select *all* of the correct answers. In other situations, directions may be given to select the *best* of several correct responses. This variation is more widely used in testing for other objectives than knowledge of information. It is often convenient to group several multiple-choice items together following an illustration, problem, or other descriptive material, thus saving time and space. For example:

When a bomb is released from an airplane the bomb continues to move horizontally with the same velocity, V, as the plane, but it also moves vertically due to gravity with the acceleration, g. Hence at t seconds after release its horizontal distance x in feet from the point of release is

$$x = Vt$$

where V is expressed in feet per second, and t is in seconds. Its vertical downward distance y is

$y = \frac{1}{2}\ gt^2$ where g is equal to 32.

To the student: With the above information in mind indicate the correct answers to the problems which follow by making a check ($\surd$) in front of the correct answer in the space provided:

1. If the airplane is traveling 300 miles per hour (440 feet per second), how far would the bomb have traveled from the point of release in 15 seconds? (*a*) ..... 3600 feet; (*b*) ..... 4500 feet; (*c*) ..... 6600 feet; (*d*) ..... 9000 feet.

2. Approximately at what height would the plane have been flying if it were traveling 300 miles per hour and 40 seconds elapsed before the bomb struck the ground? (*a*) ..... 640 feet; (*b*) ..... 12,000 feet; (*c*) ..... 17,600 feet; (*d*) ..... 25,600 feet. Problems in addition to those given above could be made up from the same information, and converted into multiple-choice items. Graphs can be used to advantage in this type of test.

When a test is made up of problems or exercises involving mathematical computations, it is ordinarily best to use a test form in which the student is required to write down the answer rather than being able to select an answer from among several alternatives. On the other hand, it is sometimes necessary to make a test entirely of the type which permits the student merely to check his answer or mark the proper space on a special answer form. In this case, best results with multiple-choice exercises can often be achieved by using the expression "none of these" or "none of the above" as one of the alternative responses. The preceding example could readily have been converted into this form by adding a fifth choice. Another example is the following:

1. Mr. Jones made a 250 mile trip. He drove the first 100 miles in 5 hours. If he increased his speed ¼ on the remaining distance, how long did it take him to make the entire trip? (*a*) ..... 9 hours; (*b*) ..... 10 hours; (*c*) ..... 11 hours; (*d*) ..... 12 hours; (*e*) ..... none of the above. When there is the likelihood that the correct answer to the item may be not among those stated, and hence is "none of the above," the student is more likely to work the exercise as is desired rather than trying to find the correct response by a process of elimination. It is of course important here as elsewhere that the alternative responses be plausible ones.

The most widely used type of exercise for measuring acquisition of knowledge in addition to the three general types previously described is the matching exercise. Fundamentally this test exercise is of the multiple-choice type in that it involves the correct selection of one or more out of several alternative answers. It can be thought of as a series of multiple-choice exercises using the same set of responses. The matching exercise, however, differs in form and in some of its possible uses, and warrants separate consideration in any description of testing devices.

In its simplest and most widely used form, the matching exercise consists of a list of questions or incomplete statements in one column or incomplete statements in a parallel column. The columns may consist of words, phrases, or figures, with directions indicating the basis on which the items in one column are to be associated, or *matched*, with those in the other. The matching exercise which is most easily prepared by an instructor is one in which the same number of items is included in each column, and each item in one column is to be matched with one and only one item in the other. For example:

1. *Directions to Student:* A numbered list of statements regarding the uses of tools in the machine shop follows. At the right is a lettered list of tools. Place in front of the appropriate statement the letter corresponding to the tool which you would use to carry out the operation suggested.

Uses of Tools in the Machine Shop	*Tools*
b 1. For cutting threads on round steel bars.	*a*) Cutting tool
c 2. For drilling holes in metal.	*b*) Die
d 3. For finishing a hole accurately to size.	*c*) Drill
e 4. For cutting threads in a hole which has been drilled to size.	*d*) Reamer
a 5. For turning a round steel bar to proper diameter on a lathe.	*e*) Tap

The obvious disadvantage of this exercise is that the student is aided by a process of elimination in selecting the correct response. Each item he answers correctly improves the odds in favor of his answering each succeeding one correctly. Thus a student's score on an exercise constructed in this manner is not an adequately accurate indication of his knowledge of the items if used separately. This difficulty can be overcome quite simply by including more items in one list than in the other, thus having some responses not used at all. For example:

2. Directions to Student: The following is a numbered list of statements regarding the uses of tools in the machine shop. At the right is a lettered list of tools. Place in front of the appropriate statement the letter corresponding to the tool which you would use to carry out the operation suggested.

Uses of Tools in the Machine Shop	*Tools*
b 1. For cutting threads on round steel bars.	*a*) Cutting tool
c 2. For drilling holes in metal.	*b*) Die
g 3. For finishing a hole accurately to size.	*c*) Drill
h 4. For cutting threads in a hole which has been drilled to size.	*d*) Fillet
a 5. For turning a round steel bar to proper diameter on a lathe.	*e*) Hob
	f) Miller
	g) Reamer
	h) Tap

Another variation which reduces the possibility of identifying the correct response by elimination is to state in the directions that one response may refer to more than one statement.

The matching exercise as described in the preceding paragraphs is more compact than the multiple-choice exercise, since the same set of alternative responses can be used for a number of items. In addition to a saving in space, this test form also saves time because generally a larger number of matching items than multiple-choice items can be answered in a given period of time. The matching exercise is probably a simpler test form than the multiple-choice exercise and may be more readily understood by persons not previously familiar with objective tests. In matching exercises in which the number of items in both columns is not the same, a further advantage is that a wider variety of responses can be listed than would be practicable in a single multiple-choice item, thus reducing the odds in favor of guessing.

On the other hand, the matching exercise as illustrated in the foregoing has several limitations. Obviously, this form should not be used unless the terms to be tested do have similar features, which may make it unsuitable for brief unit tests. Otherwise, the statements are likely to be recognizable by the student without more than a superficial knowledge of the material. Perhaps the most serious limitation of the matching exercise is that it is well adapted only to test situations in which the items

in at least one of the two columns can be single words, figures, numbers, or very brief phrases. If both columns consist of statements, the exercise is too unwieldy for convenient use. Thus the number and types of situations in which this form of exercise can be used are limited.

It is generally thought that lists of more than 10 or 12 items are inefficient because the student must spend too much of the testing time in hunting for the correct response. Five to eight items of possible responses are ordinarily the most desirable number. If the responses are numbers, they should be arranged in numerical order, and if names in alphabetical order, to aid the student in finding the response he is looking for as quickly as possible. As in all test forms, special care must be used in the directions to state clearly what basis of association is to be used, since many kinds of material could be matched in various ways.

A variation of the matching exercise which has wide application in testing for a number of objectives and which avoids some of the limitations mentioned in the foregoing is the type in which the student is asked to classify each of a number of statements into one of several categories:

3. Directions to Student: In front of each of the following statements, write the letter

a if the statement is true of direct current circuits
b if the statement is true of alternating current circuits
c if the statement is true of both d.c. and a.c. circuits
d if the statement is true of neither d.c. nor a.c. circuits

b 1. The current reverses direction periodically.
c 2. If the resistance remains constant, the current rises as the voltage is increased.
a 3. The current flows in only one direction.
b 4. The current is most commonly used for long distance transmission.
d 5. The unit of electric current is the volt.
a 6. The current is delivered by a storage battery.

This type of exercise has a wide application, and can be used in many situations in which the more traditional type of matching exercise described earlier is not suitable. It is possible, for example, to have longer statements matched in the form just shown, than is possible in the regular matching exercise. It is possible also to include a larger number of items than is generally feasible otherwise. It is best, however, to restrict the number of categories to four or five if the student is expected to complete the items with any reasonable speed and without becoming confused.

As in the case of other matching exercises, it is necessary to have the directions state clearly the basis for classification to be used. It will often happen that the same set of directions can be used for several sets of exercises of this type.

The greatest advantage of this type of matching exercise is the wide variety of test situations in which it can appropriately be used. In addition to measuring acquisition of knowledge, this type of exercise can be used in a number of situations where it would be desirable to measure skills. For example, in fields such as auto mechanics and machine-shop practice, it would be most desirable to have test situations in which the student would demonstrate the skill he has acquired. Since such a test is not always feasible, the next best device can be used: measuring his ability to select procedures which would meet the situations proposed. Such exercises are likely to be good indirect measures of skill in the subjects named, since there is usually a correlation between skill and the knowledge or thinking required in using that skill. Two examples are shown below which give an indication of a student's ability to apply basic principles of electrical circuits to a laboratory problem:

4a. A series-parallel rheostat used in the laboratory is constructed with four resistors each having 400 ohms resistance which are connected as shown in Figure 1. The resistors in the circuit may be connected in several ways depending upon the setting of the switches S_1 to S_4 inclusive. Indicate the correct positions of the switches in order to have four resistors in parallel by checking the answer you believe to be correct.

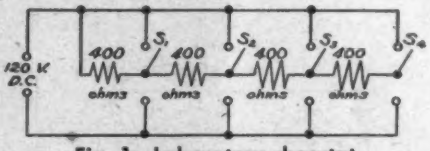

Fig. 1. Laboratory rheostat

( ) *a*) S_1, S_2, up; S_3, S_4 down
( ) *b*) S_1 up; S_2, S_3, S_4 down
(√) *c*) S_2, S_4 up; S_1, S_3 down
( ) *d*) S_2, S_3 up; S_1, S_4 down
( ) *e*) S_1, S_4 up; S_2, S_3 down

4b. It is necessary in the electrical laboratory to substitute a single series resistor for the three resistors shown in Figure 2. The value of the resistor in ohms which might be substituted for those shown here is (check the answer you believe to be correct):

( ) *a*) 0.97;
(√) *b*) 1.09;
( ) *c*) 3.00;
( ) *d*) 4.00;
( ) *e*) 12.00.

Fig. 2. Resistance problem

The construction of good tests is not a task that can be completed quickly. The most important steps will have been completed, however, when the objectives have been determined, the material to be tested has been collected, and the use of the test has been decided upon. The next job, that of building the individual items in various test situations, may require considerable time, but should not prove difficult when the ground work has been adequately prepared.

SHOP THEORY AND INFORMATION TEST

Sixth Term — Electrical Trade Class

ANTHONY J. DOMINI
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Name ..... Class.....

Test	*Score*	*Test*	*Score*
1.	.....	5.	.....
2.	.....	6.	.....
3.	.....	7.	.....
4.	.....		

Total score .....
Per cent .....

Instructions: This examination consists of a series of seven tests. They have been developed to test you in the work accomplished in the shop theory class for the term.

1. The time allotted for these tests is 90 minutes at the maximum.

2. Read the directions for each test before starting to answer the questions or working the problems.

3. Read the examples very carefully so that you may note what is wanted or required.

4. Test 1, the reading of architectural drawings and plans, consists of four parts, 28 items. Be sure to letter your answer in part I, fill in the necessary word or words in part II, write in the scaled off measurement for part III, and write on the blank lines the necessary word or figure for part IV. Each correct answer will score one point. Time 10 minutes.

5. Test 2, on trade calculations consists of 18 items. All figuring may be done on the margin or on the back of each page. Refer to the proper numbered figure in working out the problems. The score for this test is the number correct. Time 20 minutes.

6. Test 3 is a procedure arrangement test. You are required to number, in the parentheses, the proper sequence of operations in doing a certain task. Each correct order scores the amount of points shown. Total 37 points. Time 8 minutes.

7. Test 4 consists of two parts. Part I on lighting switches, and part II on circuit plotting. For part I show the positions of the switches as called for. Each correct switch position scores one point. Total 22 points. For part II finish as much of the diagram as you know, for each portion finished scores one point as shown. Total 50 points. Time 20 minutes.

8. Test 5 consists of 25 statements where you have to make one choice out of four for the correct answer. There is only one correct answer in each of these statements. The num-

ber correct is the score for this test. Time 10 minutes.

9. Test 6 consists of 25 incomplete statements, 45 items. You are to fill in the word or words that will complete the statement. The number correct is the score for this test. Time 7 minutes.

10. Test 7 consists of 75 true-false statements. Do not guess at the answers. The score for this test is the number correct minus the number wrong. It is to your advantage not to answer a question rather than to guess at the answer. Time 15 minutes.

11. Use pencil if possible. Ink also may be used.

12. The total score for the examination is 300 points. To obtain your mark in per cent divide the score obtained by three.

13. Fill in your name and class on the heading sheet and begin work at the signal.

Test 1

Part I: Symbols — Electrical and Architectural.

Directions: The symbols in the floor plan shown in Figure 1, are indicated by capital letters in parentheses. To the left of the statement in the parentheses write the letter which indicates the symbol the statement describes. Example:

(A) 30. Ceiling outlet.

Part I

( ) 1. Wall bracket
( ) 2. Wall clock outlet
( ) 3. Three-way switch outlet
( ) 4. Branch circuit — floor
( ) 5. Duplex convenience outlet
( ) 6. Brick wall
( ) 7. Double hung window
( ) 8. Single door — swinging in
( ) 9. Concrete wall
( ) 10. Stairway

Part II: For the following items write in the parentheses what the lettered item indicates. Use no more than three words. Example:

31. Item F indicates (Single pole switch)

11. Item Y indicates (.....)
12. Item T indicates (.....)
13. Item O indicates (.....)
14. Item M indicates (.....)
15. Item L indicates (.....)
16. Item R indicates (.....)
17. Item H indicates (.....)
18. Item E indicates (.....)
19. Item B indicates (.....)

Part III: For the following items determine the distance indicated by the dimension lines of the letter in the circle. Use a rule to scale the drawing. Refer to the scale on the plan.

20. The distance indicated by the dimension lines of U is (.....)
21. The distance indicated by the dimension lines of W is (.....)
22. The distance indicated by the dimension lines of V is (.....)

Part IV: For the following fill in the missing words or figures to complete the sentence.

23. Item X indicates that the door is 3 ft. 6 in. ....., by 7 ft. 0 in. ....., and 1¾ in. .....
24. Item Z indicates that the window has 3 ..... and each is ..... by .....

Test 2. Trade Calculations

Directions: Place the answer to each problem in the parentheses after the problem. Do any figuring you wish on the margin of the page or on the back of the page.

1. What is the distance from A to B in Figure 2? Use the 3-4-5 rule. ( ) in.

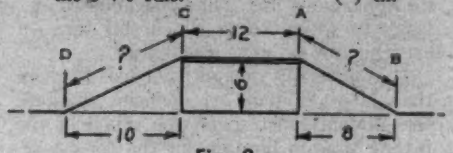


Fig. 2

2. Find the distance from C to D in Figure 2. Work out the answer to two decimal places. ( ) in.
3. Find conduit needed for saddle D-C-A-B. ( ) in.
4. What is the circumference of the circle in Figure 3 if the diameter is 5 in.? ( ) in.

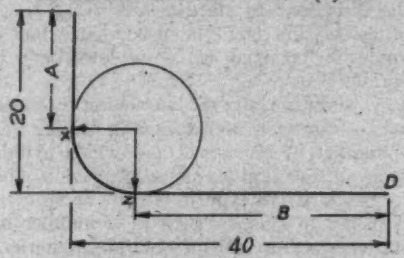


Fig. 3

5. What is the circumference of the circle in Figure 3 if the radius is 5 in.? ( ) in.
6. What would be the distance

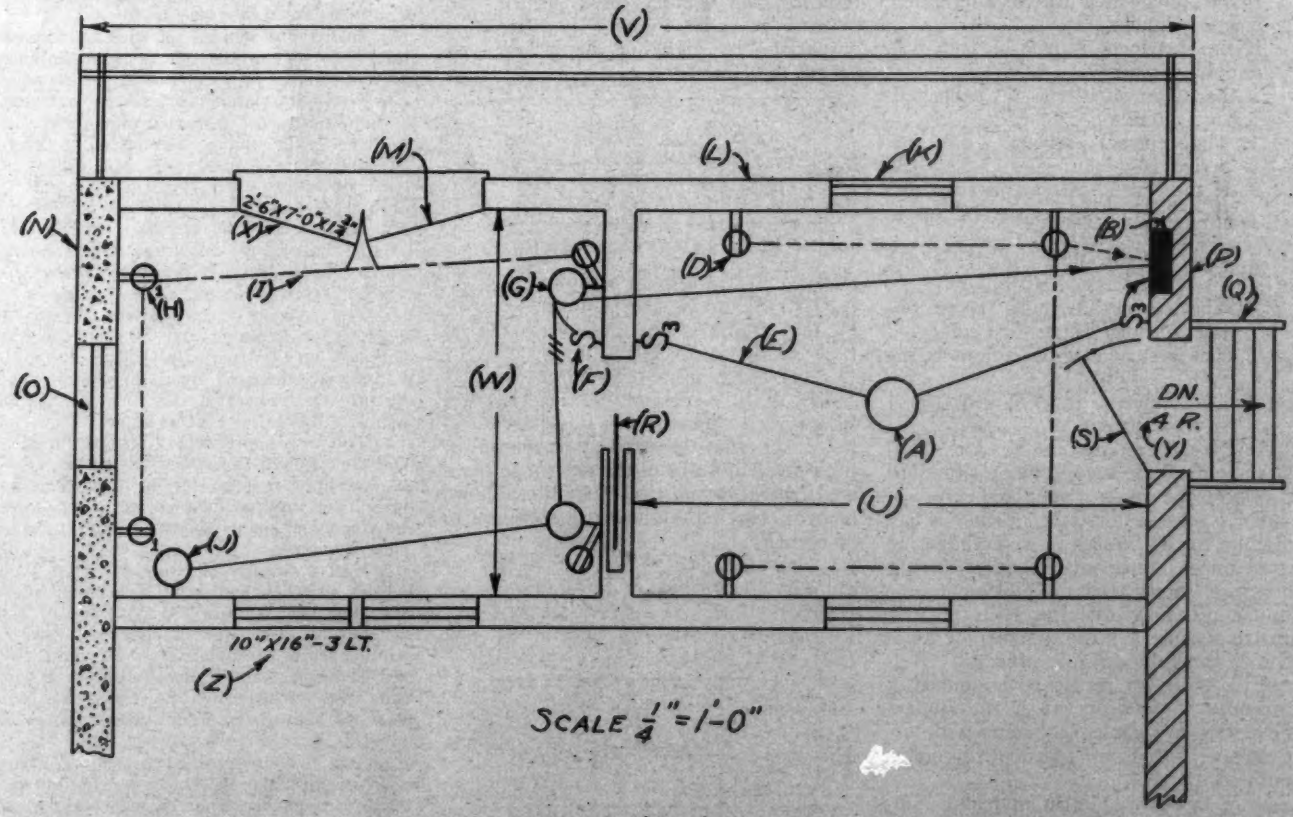


Fig. 1. Floor plan

XZ of the circle in Figure 3 if the radius were 10 in.? ( ) in.

7. Using ½-in. conduit how much conduit would be needed for the full elbow C-X-Z-D of Figure 3? Use the short trade method to obtain the answer. ( ) in.
8. What is the distance A of Problem 7? ( ) in.
9. What is the distance B of Problem 7? ( ) in.
10. What is the distance XZ of Problem 7? ( ) in.
11. Using 2-in. conduit how much conduit would be needed for the full elbow C-X-Z-D? Use the short trade method to obtain the answer. All measurements to be calculated to the center of the conduit. ( ) in.

Fig. 4

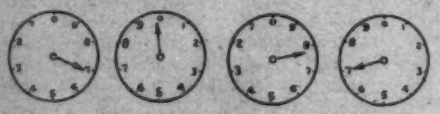
12. The coil of wire of Figure 4 contains 30 turns of wire. The mean diameter measures 2 ft. How many feet of wire are there in the coil? Use the short trade method to obtain the answer. ( ) ft.
13. If the diameter of the coil in Figure 4 is 30 in. and there are 60 turns of wire, how many feet of wire are there in the coil? Use the short trade method to obtain the answer. ( ) ft.
14. If the diameter of the coil is 27 inches and there are 10 turns of wire in the coil, find the amount of wire in the coil in feet and inches. Use the short trade method to obtain the answer. ( ) ft. ( ) in.

Reading the kilowatt hour meter.

15. Reading for month of November. ( ) Kw. hr.

16. Reading for month of December ( ) Kw. hr.

17. Reading for month of January. ( ) Kw. hr.



18. At 5 cents per kilowatt hour what would the bill be for the month of December? ($....)

Test 3. Procedure — Arrangement

Directions: Below are several steps of an operation each of which is not in its proper sequence. You are to arrange the numbers of the listed steps into their proper sequence at the left of this item.

Example: To bend a box offset in ½-in. conduit.

(3) 1. Apply pressure so that the conduit is bent slightly.
(1) 2. Push conduit into hickey head until point where bend was made is now at the forward end of the hickey head.
(2) 3. Place conduit in hickey head so that the thread extends clear.
(4) 4. Roll the conduit a full 180 deg. in the hickey and bend again to match the first bend.
( ) 5. Check for correct height and alignment of bend.

I. To bend an 8-in. elbow in ½-in. conduit. See Figure 5.

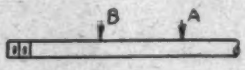


Fig. 5

( ) 1. Place hickey at mark B and bend up elbow about 30 degrees from the floor. Check to see that the elbow is close to 8 in.
( ) 2. Obtain new bite about ½ in. from mark toward mark A and close the bend. Check for correct size elbow.
( ) 3. Mark off 8 in. on the pipe. Call this mark A.
( ) 4. Mark back 5 in. from mark A. Call this mark B.

II. If the elbow in item I measures less than 8 in.

( ) 1. Place hickey close to mark A and bend to a full elbow. See Figure 6.

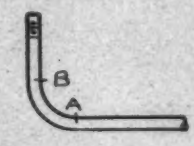


Fig. 6

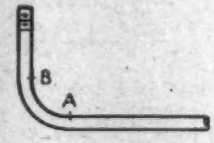


Fig. 7

( ) 2. Open the elbow slightly.
( ) 3. Check for correct size elbow.

III. If the elbow in item I measures more than 8 in.

( ) 1. Place hickey at mark B and bend to a full elbow. See Figure 7.
( ) 2. Check for correct size elbow.
( ) 3. Open elbow slightly.

IV. To bend a saddle in ½-in. conduit.

( ) 1. Bend at A marks about 30 deg. from the straight conduit as shown in Figure 8.

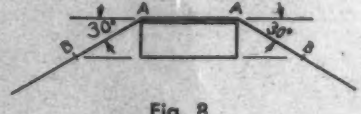


Fig. 8

( ) 2. Mark the conduit at each end of the obstruction as shown at A in Figure 8.
( ) 3. Mark the conduit at B as shown.
( ) 4. Bend at B marks so that conduit is in line with base line as shown in Figure 9.

Fig. 9

V. To gauge conductors with a B & S American wire gauge.

( ) 1. Read the number on the side of the gauge opposite the slot into which the wire fits. See Figure 10.
( ) 2. The number read is the size of the conductor.

Fig. 10

( ) 3. Skin insulation from the conductor to be gauged.
( ) 4. Hold the gauge in the left hand with the wire size markings showing.
( ) 5. Hold the conductor in the right hand and try the skinned end of the conductor in various slots of the gauge until the wire fits snugly in one of the slots.

VI. To gauge conductors with a micrometer.

( ) 1. Read the size of the wire in thousandths of an inch by referring to the sleeve and thimble markings. (See Figure 11.)
( ) 2. Hold the micrometer firmly in the right hand with the third finger holding the frame, the middle finger on top of the frame near the sleeve and the thumb and index finger operating the thimble.

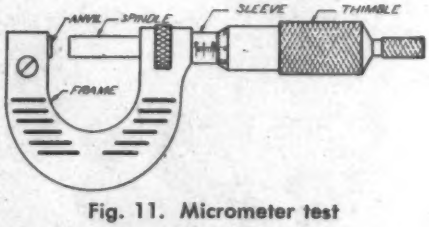


Fig. 11. Micrometer test

( ) 3. Remove insulation from end of conductor to be gauged.
( ) 4. Hold skinned end of conductor between anvil and spindle of micrometer.
( ) 5. Close the spindle until wire passes snugly through opening between anvil and spindle.

VII. To test for a blown fuse at a solid neutral cutout. (See Figure 12.)

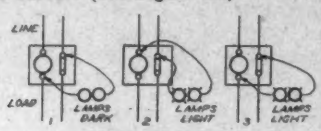


Fig. 12. Fuse test

VIII. To test for a blown fuse at a cutout where both lines are fused. See Figure 13.

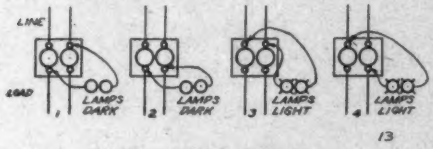


Fig. 13. Fuse test

IX. To splice wires and solder splices.

( ) 1. Splice wires.
( ) 2. Skin wires to be spliced.
( ) 3. Apply solder.
( ) 4. Apply heat.
( ) 5. Apply friction tape.
( ) 6. Apply rubber tape.
( ) 7. Apply flux.

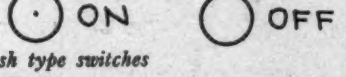
Test 4. Lighting Switches and Circuit Plotting

Part I. Show the *on* and *off* positions of the following switches: Place the sketches under the words *on* and *off* or *Position 1* and *Position 2*, etc. Each correct position scores one (1) point.

Surface snap switches

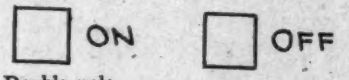
1. Single pole.

2. Double pole.

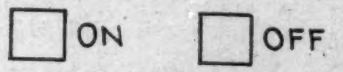


Flush type switches

3. Single pole.



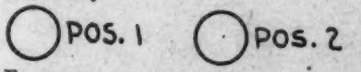
4. Double pole.



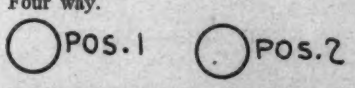
Show the two positions of the following switches:

Surface snap switches

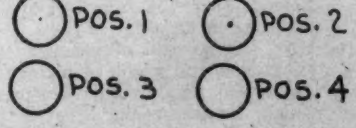
5. Three way.



6. Four way.

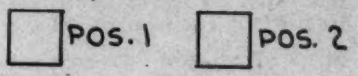


7. Two circuit electrolier-sequence 1-2-1 and 2-off.

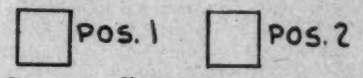


Flush type switches

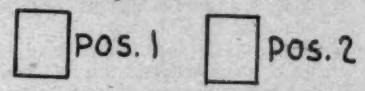
8. Three way.



9. Four way.

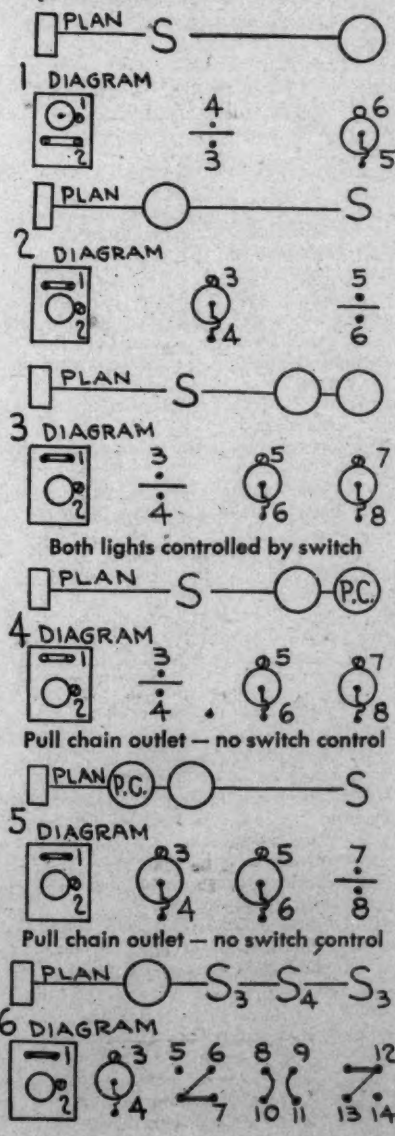


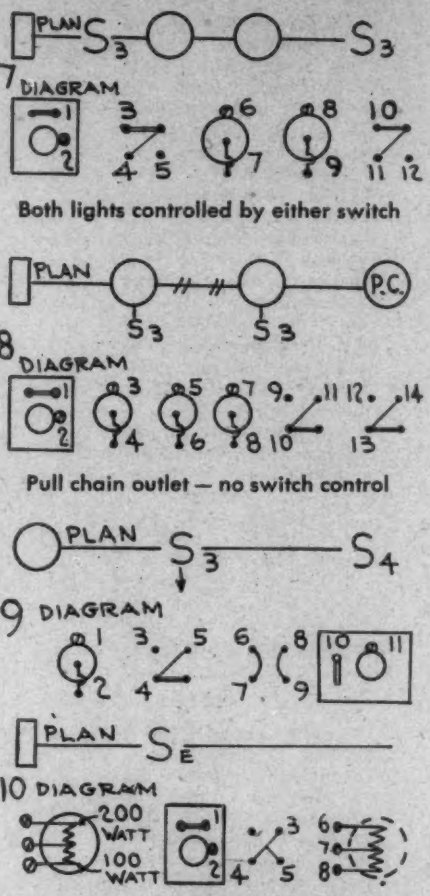
10. Four way. Show how switch is crossed internally, and position of blades for position 1 and position 2.



Part II. Show the circuit diagrams for the following plans. Complete the diagram shown below each of the plans. Each diagram will be scored as follows:

One point for each item; proper color designation of wires, connections at cutout, connections to sockets, connections to switches, completed circuit.





Test 5. Multiple Choice

Directions: Select the proper word or words which make the statement most correct. Place the *number* of the word or words selected in the parentheses to the left of each statement.

(2) Example: Wood screws are used to secure (1) metal, (2) wood, (3) concrete, (4) tile.

( ) 1. Machine screws are used to secure devices to (1) slate, (2) marble, (3) metal, (4) wood.

( ) 2. Lead expansion anchors are used in (1) plaster, (2) wood, (3) concrete, (4) hollow tile.

( ) 3. Toggle bolts are used to secure devices to (1) concrete, (2) tile, (3) hollow partitions, (4) slate.

( ) 4. Fiber anchors (rawl plugs) are used in (1) wood, (2) metal, (3) hollow partitions, (4) brick walls.

( ) 5. A Lakin hickey is used for (1) bending conduit, (2) bending molding, (3) fastening fixtures, (4) holding pipe.

( ) 6. A snake is used for (1) tying pipe, (2) hoisting pipe, (3) pulling in wires, (4) clearing obstructions.

( ) 7. An Erickson coupling is used to (1) couple two pieces of threaded pipe, (2) couple two pieces of pipe that are not threaded, (3) couple two pieces of pipe that are threaded and cannot be turned, (4) couple two

pieces of pipe that are not threaded and cannot be turned.

( ) 8. Condulets are used (1) as concealed outlets, (2) as pull boxes only, (3) as splice boxes only, (4) for neatness and convenience.

( ) 9. Stranded conductors are used because (1) they are cheaper in cost, (2) they are flexible, (3) they carry more current, (4) we cannot get solid wires.

( ) 10. Wood screws are driven with a (1) brace, (2) hammer, (3) screw driver, (4) mallet.

( ) 11. Holes for expansion anchors are drilled with (1) cold chisel, (2) star drill, (3) twist drill, (4) hand drill.

( ) 12. Holes for toggle bolts are drilled with (1) electric drill, (2) screw driver, (3) star drill, (4) hand drill.

( ) 13. The American Standard Wire Gauge is used to gauge or measure (1) steel wire, (2) sheet steel, (3) copper wire, solid, (4) copper wire, stranded.

( ) 14. Splices are soldered to (1) hold wires together, (2) make them mechanically secure, (3) make them electrically secure, (4) prevent arcing.

( ) 15. The fuel used for the alcohol blow torch is (1) wood alcohol, (2) denatured alcohol, (3) kerosene, (4) gasoline.

( ) 16. Diagonal pliers are used to (1) splice wires, (2) trim wires, (3) cut large size conductors, (4) cut flexible cords.

( ) 17. To test for blown fuses the electrician uses (1) battery test set, (2) lamp test set, (3) magneto test set, (4) megger.

( ) 18. The most common rule used by the electrician is the (1) 12-in. ruler, (2) yardstick, (3) 6-ft. zigzag rule, (4) 2-ft. folding rule.

( ) 19. Conduit can be obtained in (1) 20-ft. lengths, (2) 10-ft. lengths, (3) 5-ft. lengths, (4) any length.

( ) 20. One half-inch conduit comes in (1) single lengths, (2) 5 lengths to a bundle, (3) 10 lengths to a bundle, (4) any number of lengths to a bundle.

( ) 21. Metal molding comes in (1) 10-ft. lengths, (2) 8-ft. 4-in. lengths, (3) 8-ft. 3-in. lengths, (4) any length.

( ) 22. Wiremold comes in (1) 8-ft. 4-in. lengths, (2) 8-ft . 3-in. lengths, (3) 10-ft. lengths, (4) any length.

( ) 23. Metal molding comes in packages of (1) 100 feet, (2) 50 feet, (3) any amount, (4) 125 feet.

( ) 24. Wiremold comes in packages of (1) 100 feet, (2) 50 feet, (3) 125 feet, (4) any amount.

( ) 25. A detailed plan is drawn to a scale of ¼ inch equals 1 foot. Dimension lines on the plan measuring 10½ inches would represent an actual measurement of (1) 126 inches, (2) 14 feet, (3) 63 inches, (4) 42 feet.

Test 6. Completion

Directions: The following statements are incomplete. Read each sentence carefully and fill in the word or words that will complete the statement.

Example: Type R wire is insulated with *rubber* and a *fibrous* outer covering.

1. Fiber anchors are sometimes called ....
2. The term ..... is sometimes used for fish wire.
3. A 90-deg. bend in conduit is called a conduit .....
4. The color of the grounded neutral conductor of a circuit must be ..... or ....
5. Switches placed in a grounded type circuit must break only the ....
6. The most common colors used on wires for circuit work are ....
7. Wood screws are ordered according to ....
8. Machine screws are ordered according to ....
9. Rawl plugs are ordered according to .....
10. Lead expansion anchors are ordered by specifying .....
11. The electric meter registers electricity in ..... hours.
12. The wire gauge measures copper wire according to .....
13. The micrometer measures the ..... of wire in ....
14. Conduit is bent with the .....
15. A pipe sleeve is used to aid in ..... conduit.
16. Conduit is cut with the ..... and reamed with the pipe .....
17. Metal molding may be cut with a metal molding ..... or .....
18. Metal molding is bent with a metal molding ....
19. Wire mold is bent with a wire mold ....
20. Wire mold is cut with the .....
21. The ..... is used to remove rough edges of metal molding and wire mold.
22. Metal molding miter box is used to aid in cutting ..... in metal molding.
23. Oil is applied to the dies when threading conduit to ..... them.
24. The ..... is used to cut small size copper conductors.
25. The ..... is used to cut large size copper conductors.

Test 7. Alternate-Response or True False

Directions: The statements listed in this test are either true or false. If a statement is true, place a *T* in the parentheses before the statement. If you think the statement is false, place an *F* in the parentheses.

(T) *Example:* Copper is a good conductor of electricity.

( ) 1. Electrical work done in New York City must conform to the rules and regulations of the National Board of Fire Underwriters.

( ) 2. For temporary work splices need not be soldered.

( ) 3. Wires must be placed under binding screws in the direction that the screws turn to tighten.

( ) 4. A master electrician is a qualified person who can engage in installing, altering, and repairing electrical wiring or appliances for light, heat, or power.

( ) 5. A certificate of inspection may be either a temporary or final certificate issued to certify that an installation has been inspected and approved by the inspection department.

( ) 6. The smallest size wire permitted for general work is No. 18 wire.

( ) 7. The black wire is the identified wire of the circuit.

( ) 8. The identified wire is always connected to the screw shell of all lamp holders.

( ) 9. A circuit containing a grounded neutral wire must be protected by a fuse in each circuit wire.

( ) 10. When using plug fuse cutouts the line connects to the screw shell terminal of the cutout.

( ) 11. Cartridge fuses may be used in circuits up to 30 amperes only.

( ) 12. Link fuses are permitted in circuits for small dwelling work.

( ) 13. Series lighting may be used in residential work.

( ) 14. Multiple series lighting is used mostly for cars, car barns, tunnel lighting, and passenger and freight stations operated in connection with electric railways.

( ) 15. A round opening in the cap of a plug fuse denotes that the fuse is of over 15-ampere capacity.

( ) 16. A hexagonal opening in the cap of a plug fuse denotes that the fuse is of 15-ampere or less capacity.

( ) 17. Plug fuses may be used for circuits of over 30-ampere capacity.

( ) 18. A green label on a cartridge fuse indicates that the fuse is of over 15-ampere capacity.

( ) 19. A blue label on a cartridge fuse indicates that the fuse is of 15-ampere or less capacity.

( ) 20. A green label on a knife blade fuse indicates that the fuse is for 250-volt circuits.

( ) 21. A red label on a knife blade fuse indicates that the fuse is for 600-volt circuits.

( ) 22. In testing with a lamp test set, lamps of different wattage give best results.

( ) 23. In a two-lamp test set the lamps are connected in parallel.

( ) 24. Blown fuses are caused by open circuits.

( ) 25. A circuit may be tested for shorts by inserting a lamp in place of the blown fuse.

( ) 26. A plumb bob and a mason's chalk line may be used to mark off center lines on a wall for vertical work.

( ) 27. A medium base socket or lamp base measures 1¼ in. in diameter.

( ) 28. A mogul base socket or lamp base measures 1½ in. in diameter.

( ) 29. A single-pole switch is installed in the identified wire of a circuit.

( ) 30. Low potential means 600 volts or less.

( ) 31. High potential means 600 to 10,000 volts.

( ) 32. Extra high potential means over 10,000 volts.

( ) 33. Three-way switches break one line of the circuit.

( ) 34. An underwriter's knot is used to take away the strain from binding screws of pendant lamp holders and of plugs.

( ) 35. An overhand knot is used in the cap of a pendant socket.

( ) 36. To find the length of one turn of wire in a coil of wire multiply the diameter of the turn by π (pi).

( ) 37. To find the amount of wire in a coil

of wire multiply the diameter of the coil by π (pi).

( ) 38. To find the area of a conductor in circular mils find the diameter in thousandths of an inch and square the diameter.

( ) 39. If the resistance of a circuit is increased, the current increases.

( ) 40. The current in a circuit increases if the voltage is increased.

( ) 41. Wires of different systems shall be installed in different conduits.

( ) 42. Wires may be drawn into conduit in a building in the course of construction whenever necessary.

( ) 43. Where alternating current is employed, all conductors of a circuit shall be placed within one conduit.

( ) 44. Four No. 14 Type R wires may be drawn into ½-in. conduit.

( ) 45. Seven No. 14 Type R wires may be drawn into a ¾-in. conduit.

( ) 46. For general work conduit less than ½-in. trade size may be used.

( ) 47. Wires larger than No. 6 when used in conduit installations must be stranded.

( ) 48. Splices may be installed within a run of conduit.

( ) 49. A run of conduit between outlet and outlet, or between fitting and fitting shall have no more than the equivalent of five quarter bends.

( ) 50. Conduit runs need not be grounded.

( ) 51. No. 14 wire, Type R, can safely carry 30 amperes.

( ) 52. No. 6 wire, Type R (single conductor in free air) can safely carry 65 amperes.

( ) 53. A branch circuit is that portion of a wiring system extending beyond the final overcurrent device protecting the circuit.

( ) 54. A water level is used for leveling work such as panel boxes, switchboards, etc.

( ) 55. A spirit level can be used to level and plumb work.

( ) 56. In pulley calculations if the diameter of the driven pulley is increased its speed increases.

( ) 57. If the speed of the driving pulley is increased the speed of the driven pulley is increased.

( ) 58. If the diameter of the driving pulley is increased the speed of the driven pulley is decreased.

( ) 59. Four No. 14 wires Type R are permitted in No. 333 metal molding.

( ) 60. Four No. 14 wires Type R are permitted in No. 500 wire mold.

( ) 61. The fluorescent lamp operates on the principle of a current of electricity heating a filament to incandescence.

( ) 62. The fluorescent lamp can operate directly from the house current supply.

( ) 63. The fluorescent lamp needs special starting equipment to cause it to operate.

( ) 64. Fluorescent lamps will not operate properly where exposed to drafts of cold air.

( ) 65. The ballast used in the fluorescent fixture is a current limiting device.

( ) 66. The most widely used starter is known as the glow switch starter.

( ) 67. Blackening of the ends of a fluorescent lamp is normally a sign of age in service.

( ) 68. The fluorescent lamp is known as the Mazda F lamp.

( ) 69. The fluorescent lamp can be operated on alternating current only.

( ) 70. The operation of fluorescent lamps under certain conditions may cause a buzzing sound in near-by radios.

( ) 71. Neon tubes are operated on low voltage.

( ) 72. Neon tubes use special gases at reduced pressure.

( ) 73. Neon signs need a special high-voltage transformer for proper operation.

( ) 74. High-tension conductors used for neon sign work are the same as Type R wire.

( ) 75. Connections to neon tube electrodes are made with connection blocks.

KEY TO TESTS

Test 1

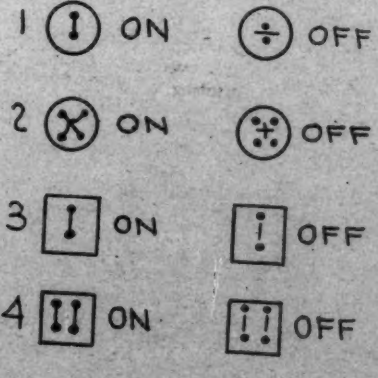
1. (G)
2. (J)
3. (C)
4. (I)
5. (D)
6. (P)
7. (K)
8. (S)
9. (N)
10. (Q)
11. Riser
12. Break in drawing
13. Single sash
14. Double door
15. Frame wall
16. Sliding door
17. Single convenience outlet
18. Branch circuit — ceiling
19. Panel box
20. 12 ft. 6 in.
21. 9 ft. 3 in.
22. 27 ft. 0 in.
23. wide, high, thick.
24. lights, 10 in. 16 in.

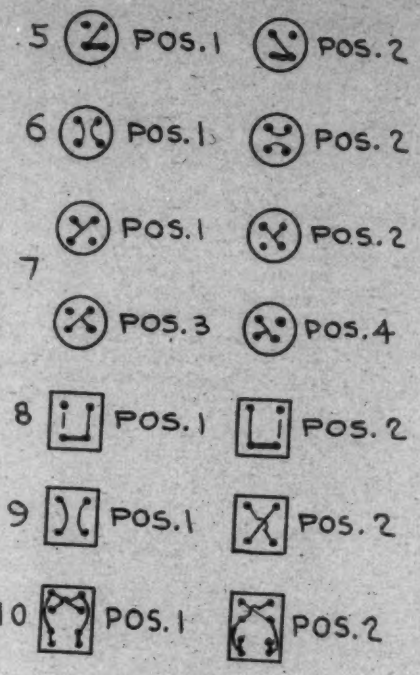
Test 2

1. 10 in.
2. 11.66 in.
3. 33.66 in.
4. 13.7 in.
5. 31.41 in.
6. 7.85 in.
7. 56. in.
8. 10 in.
9. 30 in.
10. 15 in.
11. 57.6 in.
12. 180 ft.
13. 450 ft.
14. 67 ft. 6 in.
15. 6977
16. 7162
17. 9999
18. $9.25

Test 3

I. 1. (3) 2. (4) 3. (1) 4. (2)
II. 1. (2) 2. (1) 3. (3)
III. 1. (3) 2. (1) 3. (2)
IV. 1. (2) 2. (1) 3. (3) 4. (4)
V. 1. (3) 2. (4) 3. (5) 4. (1) 5. (2)
VI. 1. (3) 2. (2) 3. (4) 4. (5) 5. (1)
VII. 1. (2) 2. (1)
VIII. 1. (3) (3) 2. (2) or (2) 3. (1) (4) 4. (4) (1)
IX. 1. (2) 2. (1) 3. (4) 4. (7) 5. (3) 6. (6) 7. (5)





Test 4 — Part 2

1. Connect 2 to 6, wire color — white
   1 to 3, wire color — black
   4 to 5, wire color — red or black
2. Connect 1 to 3, wire color — white
   4 to 5, wire color — red or black
   2 to 6, wire color — black
3. Connect 1 to 5 & 7, wire color — white
   2 to 4, wire color — black
   3 to 6 & 8, wire color — red or black
4. Connect 1 to 5 & 7, wire color — white
   2 to 4 & 8, wire color — black
   3 to 6, wire color — red or black
5. Connect 1 to 3 & 5, wire color — white
   6 to 7, wire color — red or black
   2 to 4 & 8, wire color — black
6. Connect 1 to 3, wire color — white
   4 to 12, wire color — red or black
   2 to 7, wire color — black
   5 to 9, wire color — any other color
   6 to 8, wire color — any other color
   11 to 13, wire color — any other color
   10 to 14, wire color — any other color
7. Connect 1 to 6 & 8, wire color — white
   7 to 9 & 10, wire color — red or black
   2 to 3, wire color — black
   5 to 11, wire color — any other color
   4 to 12, wire color — any other color
8. Connect 1 to 3, 5 & 7, wire color — white
   2 to 9, 14 & 8, wire color — black
   10 to 13, wire color — any other color
   4 to 11, 12 & 6, wire color — red
9. Connect 4 to 11, wire color — black
   2 to 10, wire color — white
   1 to 9, wire color — red
   3 to 8, wire color — any other color
   5 to 6, wire color — any other color
   7 — No connection
10. Connect 2 to 3, wire color — black
    5 to 6, wire color — red or black
    4 to 8, wire color — red or black
    1 to 7, wire color — white

Test 5

1. (3) 2. (3) 3. (3) 4. (4) 5. (1) 6. (3) 7. (3) 8. (4) 9. (2) 10. (3)

11. (2)	14. (3)	17. (2)	20. (3)	23. (1)
12. (3)	15. (2)	18. (3)	21. (2)	24. (1)
13. (3)	16. (2)	19. (2)	22. (3)	25. (2)

Test 6

1. rawl plugs	13. diameter, thousandths of an inch
2. snake	14. hickey
3. elbow	15. bending
4. white, natural gray	16. hack saw, reamer
5. live wire or hot leg	17. cutter, hack saw
6. black, white, red	18. bending tool
7. size, length, head, material	19. bending tool
8. size, length, head, material	20. hack saw
	21. file
9. size	22. miters
10. size	23. cool
11. kilowatt	24. plier
12. size	25. hack saw

Test 7. Authority for code answers, New York City Electrical Code

1. F	16. T	31. F	46. F	61. F
2. F	17. F	32. F	47. T	62. F
3. T	18. T	33. T	48. F	63. T
4. T	19. T	34. T	49. F	64. T
5. T	20. T	35. F	50. F	65. T
6. F	21. T	36. T	51. F	66. T
7. F	22. F	37. F	52. T	67. T
8. T	23. F	38. T	53. T	68. T
9. F	24. F	39. F	54. F	69. F
10. F	25. T	40. T	55. T	70. T
11. F	26. T	41. T	56. F	71. F
12. F	27. F	42. F	57. T	72. T
13. F	28. T	43. T	58. F	73. T
14. T	29. F	44. T	59. T	74. F
15. T	30. T	45. T	60. F	75. F

DIAGNOSTIC AND PROGNOSTIC TESTS FOR PRINT-SHOP CLASSES

ISADORE M. FENN
Chicago Vocational School
Chicago, Ill.

Part	Title	Possible Score	Score
1.	True and False	54	.....
2.	Completion	28	.....
3.	Matching (Terms and Definition)	75	.....
4.	Matching (Proofreader's Marks)	23	.....
5.	Recognition (Parts of a Type Character)	10	.....
6.	Recognition (Tools)	10	.....
Total		200	.....
Rank			

Fill in all the blanks. Write plainly. Then read the directions below.

Name..... Birthday..... Age..
School..... City..... State.....
Instructor..... Date..... Grade...

In what other grades have you had the following:

Printing... Bookbinding... Papermaking...

Directions: This test is divided into six parts and consists of four different types of questions in printing, bookbinding, and papermaking. There are directions before each part of this test. Begin to answer the questions only after you have carefully read the directions. When you have finished one part, go on to the next. Do not ask any questions after the test begins.

PART 1 — True and False

Directions: Place a *T* before each statement that you think is true, and an *F* before each statement that you think is false. *Do not guess.*

( ) 1. Printing, as it concerns us, is only about 500 years old.
( ) 2. Gutenberg is credited with being the first printer of Europe who made printing with movable types of real usefulness.
( ) 3. The work of Gutenberg and other early printers is comparable with the best done today.
( ) 4. The first press in America was established in Mexico in 1536.
( ) 5. In the early days the printer would buy the type and paper he needed.
( ) 6. Forty-two Line Bible gets its name from the fact that each page has two columns of 42 lines.
( ) 7. A new type designed and cast by William Caslon in 1734 became known as the Caslon Old Style.
( ) 8. Caslon Old Style became the model for the standard book types of today.
( ) 9. From the year 1840 a very few number of inventions appeared which improved type setting and type casting.
( ) 10. The Linotype machine allows for the casting of a line of type in solid form.
( ) 11. The Monotype machine casts only the particular letter that is wanted.
( ) 12. Display work and important books are never hand set.
( ) 13. With the use of the Gutenberg press a workman could print 300 sheets in a working day.
( ) 14. The two-revolution cylinder press feeds and delivers automatically.
( ) 15. The largest presses built for newspaper printing are called rotary presses.
( ) 16. Rotary presses do not use paper directly from the roll.
( ) 17. Rotary presses not only print but also cut, fold, and print color work at the same run.
( ) 18. After taking a proof, the type should not be washed with cleaning fluid.
( ) 19. Type sizes are indicated as follows: 6 point, 8 point, 10 point, 12 point, 14 point, etc.
( ) 20. The point is equal to approximately one seventy-second of an inch.
( ) 21. Type is always tied up in the stick before placing the job in the galley.
( ) 22. In order to make dotted lines, leaders are used.
( ) 23. The printer today uses the camera as his engraver.
( ) 24. Wood engraving is one of the newest methods of illustration.
( ) 25. Half-tone plates are used in printing color work.
( ) 26. Lithography is the art of drawing or writing on a stone or metal surface so that it may be reproduced by printing.
( ) 27. Rotogravure is a process of intaglio printing in which a copper cylinder is etched and used to make impressions for printing.
( ) 28. Linoleum block print designs may only be printed in black and white.
( ) 29. Years ago skins of animals were used as writing material.
( ) 30. The first sort of paper was made by the Egyptians from the papyrus plant.
( ) 31. Papyrus and parchment were real papers.
( ) 32. Parchment that was made from the skin of young calves was in later years called "vellum."
( ) 33. Vellum is the most beautiful and suitable material for writing or printing.
( ) 34. The Chinese are given the credit for making the first real paper in about the year A.D. 100.
( ) 35. Paper first became available for the United States in the twentieth century.
( ) 36. In 1799, Louis Roberts, a Frenchman, conceived the idea of making paper on a movable, endless wire screen.
( ) 37. The first practical papermaking machine was constructed in 1804.
( ) 38. The first practical papermaking machine reduced the cost of papermaking considerably.
( ) 39. There are two chief ways in which sizing is done in the paper industry, by machine and by hand.
( ) 40. Machine sizing ("engine sizing") is done by mixing rosin with the paper pulp.
( ) 41. The hand sizing ("tub sizing") is done before the paper is made and dried, by dipping it into a sizing bath.
( ) 42. Paper is dyed for the purpose of making the sheet more pleasing to the eye, and for decorative purposes.
( ) 43. Paper is never dyed while in the pulp state by adding water soluble colors to the pulp.
( ) 44. Cheap paper is sometimes colored in order to hide or cover up the poor grade of materials from which the paper pulp is made.
( ) 45. Starch sizing is used chiefly for handmade papers.
( ) 46. Paper is purchased on the basis of its weight per ream of 500 sheets for a particular size.
( ) 47. The finish of the paper used in printing is very seldom the point chiefly considered.
( ) 48. The texture of paper is determined by holding a single piece to the light so that the light is back of the sheet.
( ) 49. A patchy, cloudy appearance indicates a poor grade of paper.
( ) 50. Blotting or mimeograph paper has little strength.
( ) 51. Good paper will not crack or tear when it is crumpled and rubbed.
( ) 52. The cutting of paper stock is not an important operation in the printing business.
( ) 53. Waste stock is the paper left over after the desired sheets have been cut out.
( ) 54. A great many of the large producers of printed matter use the hypotenuse oblong as their method of determining page size proportions.

Right .. minus wrong .. = score ..

PART 2 — Completion

Directions: Fill in the blanks with the necessary words to complete each of the following sentences.

1. ..... began printing from movable type in Mainz, Germany.
2. The ..... invented and used the method of printing from blocks hundreds of years before it was known elsewhere.
3. The first complete book printed with movable type at Mainz by Gutenberg and Fust is .....

4. In 1476 ..... introduced the art of printing into England.
5. Up to 1465 the ..... and the ..... were the only type faces in use.
6. In the early part of the sixteenth century a new type in the shape of ..... was cut.
7. In order to make the correction of a letter in a line, the complete line has to be recast in the ..... machine.
8. In the ..... machine corrections can be made by substituting single types.
9. The early printing press was built like a ..... cheese press.
10. The first press used by ..... was said to be of this type.
11. The ..... was one of the first to perfect presses which printed on both sides of the paper in one operation.
12. ..... presses are used for most of the bookwork printing and fine color work.
13. Modern presses are grouped into three classes: 1. ..... 2. ..... 3. .....
14. The most common type press is the .....
15. The ..... press is used for jobs which are printed in small quantities, such as announcements, handbills, cards, programs, and letter heads.
16. The ..... press can be found in most small printing shops and in shops producing general printing.
17. The common type of cylinder press used in the United States is called a ..... press.
18. ..... presses are the largest, fastest, and most astounding presses built today.
19. The printer's system of measurement is known as the ..... system.
20. Type metal is made up of 80 per cent ..... and the rest copper, tin, and antimony.
21. Copper, tin, and antimony are used in the alloy to ..... the type metal.
22. The case we use in printing is known as the ..... case.
23. In setting type by hand it is proper to use a ..... stick.
24. Type is set in the stick from ..... to .....
25. The stick is built so that one side can be ..... to accommodate the length of the line desired by the compositor.
26. Spacing lines of type so that each line will be snug in the stick, and all lines will be set exactly the same width is called .....
27. Machine bookbinding was started and developed in .....
28. The ..... process is the most commonly used for making printing plates.

Right.... minus wrong.... = score....

PART 3 — Matching
(Terms and Definitions)

Directions: This test consists of 75 definitions. There also is a table of numbered words to which these definitions apply. Write the numbers of the words before the definitions to which they apply.

1. Tweezers
2. Kerned letter
3. Imposing stone
4. Furniture
5. Galley
6. Job type
7. Italics
8. Leads
9. Nonpareil
10. Dummy
11. Hell box
12. Leaders
13. Ligatures
14. Line gauge
15. Nickeltypes
16. Ascender
17. Brayer
18. Job case
19. Chase
20. Composing stick
21. Cuts
22. Cylinder press
23. Em
24. En
25. Display type
26. Half tone
27. PI
28. Pica
29. Point system
30. Proof
31. Proof marks
32. Slugs
33. Proof press
34. Quads
35. Spaces
36. Serif
37. Reglet
38. Type matter
39. Caption
40. Body type
41. Copy
42. Characters
43. Hieratic
44. Centered
45. Descender
46. Dirty proof
47. Relief printing
48. Rotogravure
49. Photogravure
50. Printing plate
51. Lithography
52. Letterpress printing
53. Impression
54. Justification
55. Distribution
56. Electrotype
57. Engraving
58. Form
59. Etching
60. Font
61. Cover board
62. Cloth bookbinders
63. Make-up
64. Buckram
65. Bookbinding case
66. Section
67. Manuscript
68. Deckel
69. Deckel edge
70. Papermaking mold
71. Parchment
72. Papyrus
73. Paper pulp
74. Ream
75. Watermark

Example: (14) 1. The measuring rule used by the printer.

( ) 1. A part of the face of a letter that extends beyond the body of the type.
( ) 2. Wood or metal blocks less than type-high, used for placing around type forms for locking in chases.
( ) 3. Type used for job composition which involves display.
( ) 4. A unit of the point system or printer's measure equal to six point or one twelfth of an inch.
( ) 5. The trade name given to a container into which broken or battered type characters are thrown.
( ) 6. Type characters cast in multiples of em sizes used for printing dotted lines.
( ) 7. A general layout for a booklet or folder.
( ) 8. A flat metal tray used as a receptacle for type forms during composing, while being tied up, and before distribution.
( ) 9. Thin strips of type metal less than type-high, used for spacing between lines.
( ) 10. Two or more type characters cojoined and cast on one body.
( ) 11. Type sloped to give emphasis or to introduce pleasing contrasts in the letter forms.
( ) 12. Pincers used in removing type while making corrections in a job.
( ) 13. Nickel-covered printing plates mounted on wooden or metal bases.
( ) 14. The measuring rule used by the printer.
( ) 15. A table with a stone or steel surface upon which type is placed.
( ) 16. A wooden tray divided into compartments, called "boxes," of varying sizes, into which different letters of type are placed.
( ) 17. A case iron or steel frame, within which type forms are enclosed and locked up for the press.
( ) 18. An engraved block or plate used for reproducing illustrations.
( ) 19. The square of the type body.
( ) 20. One half the width of an em body.
( ) 21. A small hand roller used to ink type forms which are to be proofed on a proof press.
( ) 22. A printing plate, the lines of which are in relief. A photoengraving produced by etching a plate that is photographed through a fine ruled glass screen.
( ) 23. That portion of a type character which rises above the body, such as: b, d, f, h, k, l, and t.
( ) 24. A metal receptacle with three sides, one of which is adjustable, within which type is set.
( ) 25. Type matter or part of a form which has been mixed up or confused.
( ) 26. The printer's system of measuring, approximately one seventy second of of an inch, or more exactly .0138 of an inch.
( ) 27. Type which bears more evidence of design in its construction and is used for open display work.
( ) 28. Marks or symbols used to indicate corrections to be made in a proof.
( ) 29. Equal to 12 points or approximately one sixth of an inch. The unit of measure of the point system.
( ) 30. The impression of a type form on a sheet of paper, taken for the purpose of inspecting and correcting the job before it is printed.
( ) 31. Strips of type metal below type height, five or more points in thickness, used for spacing and filling in blank space forms.
( ) 32. A press consisting of a cylinder upon which the sheet of paper rotates, and a flat bed upon which printing form is held. This bed moves backward and forward upon a track.
( ) 33. The heading of a chapter or of a page.
( ) 34. The fine cross strokes put as a finish at the top or bottom of the letter.
( ) 35. Type bodies which are subdivisions of the em quad, used for spacing between words and for justification of lines. These type bodies are less than type-high.
( ) 36. That part of a type character which projects below the line of the printing face, that is, g, j, p, s, and y.
( ) 37. Plain, light faced letters used for body composition. Not designed for ornament.
( ) 38. Type bodies, less than type-high, used for separating words in lines at the ends of paragraphs and for indentions.
( ) 39. The written or printed material which is to be composed.
( ) 40. Composition in straight paragraph form.
( ) 41. When the margins on each side of a line of type are equal, the composition is said to be centered.
( ) 42. A graphical symbol used in the recording of language.
( ) 43. A style of ancient Egyptian writing.
( ) 44. Narrow strips of wood, the thickness of a pica or nonpareil, less than type-high, used for locking of forms and as substitutes for slugs in composition.
( ) 45. A small hand or automatic press upon which type forms may be proofed without locking in a chase.

( ) 46. All printing that is done from the raised surfaces of type, half tones, or etchings.
( ) 47. A plate which is engraved or etched, stereotyped or electrotyped, from which printing is done.
( ) 48. Using photographic methods in making intaglio plates for printing.
( ) 49. Intaglio printing done from engraved cylinders on a rotary press.
( ) 50. Impressions of words on paper or other material directly from type and distinguished from printing by plates.
( ) 51. Printed impressions produced from a drawing made on a flat lithographic stone or metal plate.
( ) 52. A process of producing a print from a plate in which the lines are cut below the surface.
( ) 53. A process of producing a printing plate by the action of an acid on the exposed surfaces.
( ) 54. An assortment of one size and style of type, containing the proper apportionment of each letter in accordance with the frequency of its use.
( ) 55. Uniformly spacing out of lines of type in the composing stick to the proper length.
( ) 56. A copper-covered printing plate which is a reproduction of a cut or type matter mounted on a wooden or metal base to make it type-high.
( ) 57. A printed copy of type matter taken on a press.
( ) 58. A proof of a type form which contains numerous errors.
( ) 59. The work of replacing type characters and composing materials to their proper places after using them in a job.
( ) 60. A combination of type or printing surfaces which has been locked up in a chase, ready for an impression.
( ) 61. A glaze colored cloth used for covering books and also as a hinge for small folders.
( ) 62. A coarse cloth of linen or hemp, reinforced with size or glue, used to strengthen the back of books.
( ) 63. A frame which forms the border of a papermaking mold.
( ) 64. A part or subdivision of a book.
( ) 65. A book cover which is made separately and put on books later.
( ) 66. A package of paper containing 500 sheets.
( ) 67. A trade-mark or design produced in some grades of paper during manufacture by making the paper thinner at the desired place. The mark can be seen by holding the paper to the light.
( ) 68. A cardboard used in making the cover of books.
( ) 69. The feathery, ragged edge of a paper which gives a pleasing touch to some kinds of printing.
( ) 70. The skin of a sheep or goat, prepared so that it can be used to write upon.
( ) 71. Assembling and arranging of jobs on a galley.
( ) 72. A hand written composition, as an ancient book.
( ) 73. A writing material, produced from a tall reed growing along the Nile, used by the Egyptians, Greeks, and Romans.
( ) 74. A frame with a wire cloth bottom, used in making paper by hand, on which the pulp is drained to form a sheet.
( ) 75. A mass of material formed from rags, wood, or old paper used in the manufacture of paper.

Right . . minus wrong . . = score . .

PART 4 — Matching (Proofreaders' Marks)

Directions: This part consists of two columns with numbers in front of the left-hand column. You are to match the meanings in the left-hand column with the proofreaders' marks in the righ-hand column by placing the number of the meaning in the left-hand column in front of the proofreader mark in the right column. Do not guess.

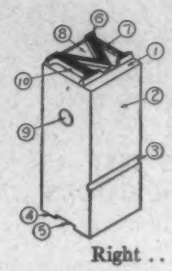
( ) 1. Take out defective letter
( ) 2. Push down space
( ) 3. Insert a letter
( ) 4. Take out
( ) 5. Wrong font letter
( ) 6. Transpose
( ) 7. Let it stand
( ) 8. Straighten lines
( ) 9. Move to left
( ) 10. Move to right
( ) 11. Make a new paragraph
( ) 12. No paragraph; run in
( ) 13. Use capital letters
( ) 14. Equalize the spacing
( ) 15. One em space
( ) 16. Quotation marks
( ) 17. Period
( ) 18. Comma
( ) 19. Semicolon
( ) 20. Colon
( ) 21. Apostrophe
( ) 22. Hyphen
( ) 23. Em dash

1. 9 or 9
2. caps
3. ✱
4. □
5. ⊙
6. ⌇
7. ⌇
8. ⊘
9. ⊕
10. ⊕
11. ⌐
12. ⊐
13. x
14. ⊥
15. ⊃
16. ⁂
17. ⁂
18. ⁄
19. ⁋
20. ⁊
21. ⁅
22. =
23. ⁓

Right . . minus wrong . . = score . .

PART 5 — Recognition (Parts of a Type Character)

Directions: Fill in the blanks with the name that corresponds to that particular part in the drawing of the type character.



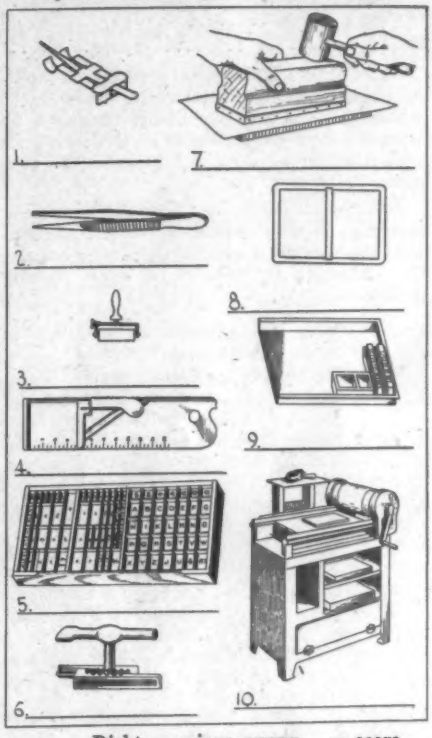
Names of Parts

1. .....
2. .....
3. .....
4. .....
5. .....
6. .....
7. .....
8. .....
9. .....
10. .....

Right . . minus wrong . . = score . .

PART 6 — Recognition (Tools)

Directions: Write the name of the tool in the space below the picture. Do not guess.



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Right . . minus wrong . . = score . .

KEY — Part 1

1. T	12. F	23. T	34. T	45. T
2. T	13. T	24. F	35. F	46. T
3. T	14. T	25. T	36. T	47. F
4. T	15. T	26. T	37. T	48. T
5. F	16. F	27. T	38. T	49. T
6. T	17. T	28. F	39. T	50. T
7. T	18. F	29. T	40. T	51. T
8. T	19. T	30. T	41. F	52. F
9. F	20. T	31. F	42. T	53. T
10. T	21. F	32. T	43. F	54. T
11. T	22. T	33. T	44. T	

Part 2

1. Johannes Gutenberg
2. Chinese
3. Forty-two line Bible
4. William Caxton
5. Gothic, Roman
6. Italic
7. Linotype
8. Monotype
9. Medieval
10. Gutenberg
11. Hoe Company of N. Y.
12. Cylinder
13. 1. Platen, 2. Cylinder, 3. Rotary
14. Gordon
15. Platen
16. Platen
17. Two-revolution cylinder
18. Rotary
19. Point
20. Lead
21. Harden
22. California Job
23. Composing
24. Left to right
25. Adjusted
26. Justification
27. United States
28. Half tone

Part 3

1. 2	16. 18	31. 32	46. 47	61. 62
2. 4	17. 19	32. 22	47. 50	62. 64
3. 6	18. 21	33. 39	48. 49	63. 68
4. 9	19. 23	34. 36	49. 48	64. 66
5. 11	20. 24	35. 35	50. 52	65. 65
6. 12	21. 17	36. 45	51. 51	66. 74
7. 10	22. 26	37. 40	52. 57	67. 75
8. 5	23. 16	38. 34	53. 59	68. 61
9. 8	24. 20	39. 41	54. 60	69. 69
10. 13	25. 27	40. 38	55. 54	70. 71
11. 7	26. 29	41. 44	56. 56	71. 63
12. 1	27. 25	42. 42	57. 53	72. 67
13. 15	28. 31	43. 43	58. 46	73. 72
14. 14	29. 28	44. 37	59. 55	74. 70
15. 3	30. 30	45. 33	60. 58	75. 73

Part 4

1. 13	6. 23	11. 19	16. 9	21. 10
2. 14	7. 16	12. 1	17. 5	22. 11
3. 15	8. 22	13. 2	18. 6	23. 12
4. 17	9. 21	14. 3	19. 7	
5. 18	10. 20	15. 4	20. 8	

Part 5

1. Shoulder
2. Body
3. Nick
4. Foot
5. Groove
6. Serif
7. Face
8. Counter
9. Pin mark
10. Neck or beard

Part 6

1. Gauge pin
2. Tweezers
3. Brayer
4. Composing stick
5. California job case
6. Quoins with key
7. Mallet and planer
8. Chase
9. Galley
10. Proof press

INDUSTRIAL-ARTS TEST — METAL CONSUMER GOODS

W. H. BOWERS

Supervisor

High School

Tuckahoe, N. Y.

Student's Name .....

Date ..... Score .....

Instructions: Deduct 1.5 per cent for each statement answered incorrectly. Read each statement very carefully before placing a *T* or an *F* before the statement. When your test average is computed enter it opposite the word *score*.

Directions: Read the following sentences carefully. If a statement is correct, place a *T* in the parentheses before the statement. If the statement is false, place an *F* in the parentheses.

( ) 1. Modern civilization is built on a framework of wood.
( ) 2. Metals are not new to man.
( ) 3. Tools, pots, and nails were machine made since the year 1670.
( ) 4. Metals did not reach their maximum usefulness until the machine age.
( ) 5. Objects made by hand are usually cheaper than those that are machine made.
( ) 6. The most important metal is copper.
( ) 7. The largest sources of iron are the United States, Russia, and Germany.
( ) 8. A blast furnace is about 90 feet in height and 25 feet in diameter.
( ) 9. Limestone is used in a blast furnace to aid the molten iron ore to cling together.
( ) 10. Slag being heavier than the molten iron ore is withdrawn from the bottom of the blast furnace.
( ) 11. Steel is refined pig iron.
( ) 12. Cast iron is hard and brittle, therefore it breaks easily.
( ) 13. Wrought iron because of its method of being made is the poorest grade of iron.
( ) 14. Cast iron is molded into numerous shapes such as razor blades, knives, scissors, and needles.
( ) 15. Because of care needed to stir and mix the pig iron with iron oxide only a comparatively small amount of wrought iron can be made at a time.
( ) 16. There is but one method of making steel. This process is called the Bessemer process.
( ) 17. The electric furnace besides being expensive to operate produces a poor grade of steel.
( ) 18. Wrought iron is used for pipes, anchors, bolts, nails, and decorative pieces.
( ) 19. During the refining of pig iron into steel, carbon is added to the pig iron.
( ) 20. The open-hearth process is a method of making pig iron.
( ) 21. Cast steel or crucible steel is an expensive steel because it must be carefully made.
( ) 22. Cast steel is used for radiators, fireplugs, manholes, lampposts, and trolley-car wheels.
( ) 23. The temper of steel is its degree of hardness.
( ) 24. The terms annealing, hardening, and tempering all mean the same thing.
( ) 25. Machine steel, that can be filed or turned on a lathe, cannot be hardened and tempered like tool steel.
( ) 26. Oil tempering is a process of tempering steel by heating the steel to the ignition point of oil and quenching the steel in oil.
( ) 27. Steel with very little carbon content can be readily tempered.
( ) 28. The best cutlery or knives are made from iron and chromium.
( ) 29. Crucible steel and stainless steel knives won't hold an edge and will rust very quickly.
( ) 30. To test the rust-resisting qualities of a knife dip it in vinegar and let it dry. If it shows spots, it is not rust resisting.
( ) 31. Steel wool is nothing more than shavings of various diameters of tempered steel.
( ) 32. Ninety per cent of all steel wool is manufactured in England.
( ) 33. Steel wool is used for polishing and scraping metals or woods.
( ) 34. Galvanized iron is iron that has been coated with tin.
( ) 35. Garbage cans, ash cans, water pails, gutters, and roofs are made of galvanized iron.
( ) 36. Although the coating may be gone on galvanized products the material will not rust.
( ) 37. The purpose of the coating is to keep the oxygen and moisture of the air from contact with the iron.
( ) 38. There is much steel used in the average school classroom.
( ) 39. The ingredients used in making enamel for enameling pots, stoves, and plumbing fixtures are potash, alumina, feldspar, borax, sand, and soda.
( ) 40. Before a steel pot is enameled it is cleaned with steel wool.
( ) 41. Frit is tiny pieces of steel.
( ) 42. All enamelware must be fired as a final process of manufacture.
( ) 43. Enamelware is tough and can be struck with a hammer without harming it.
( ) 44. Enamelware may be cleaned with a wire brush.
( ) 45. In selecting a new piece of enamelware, one that is chipped will give just as satisfactory service as one not chipped.
( ) 46. Ears, handles, and spouts on enamelware are soldered in place.
( ) 47. Aluminum is the most abundant metallic substance on earth.
( ) 48. The method of obtaining aluminum was invented early in 1725.
( ) 49. Bauxite is the ore from which aluminum is now obtained.
( ) 50. Aluminum is heavy and hard to handle.
( ) 51. Aluminum suffers less than other metals from vibration and fatigue.
( ) 52. Aluminum is a poor conductor of heat and electricity.
( ) 53. Today most of the bauxite comes from England, Germany, and New York State.
( ) 54. Never use steel wool on aluminum as it will chip off.
( ) 55. Zinc was used in ancient China and India.
( ) 56. England is the greatest producer of zinc.
( ) 57. The supply of zinc is plentiful.
( ) 58. After zinc ore is mined, the metal is obtained by separating it by electricity.
( ) 59. Zinc will rust, therefore it cannot be exposed to rain and snow.
( ) 60. Zinc is very soft and malleable.
( ) 61. Zinc is used in the making of paints and rubber.
( ) 62. Lead has the same excellent qualities of iron but it does not rust.
( ) 63. Lead is rarely found and is very scarce.
( ) 64. Lead must be mined from very deep mines.
( ) 65. Lead is a soft, malleable metal of low tensile strength.
( ) 66. Some of the uses of lead are for paints, pottery, glazes, solder, storage battery plates, and ammunition.
( ) 67. Tin is obtained from Bolivia, the Dutch East Indies, and the Malay States.
( ) 68. Tin is bluish-white, soft and malleable.
( ) 69. Tin makes very good cooking utensils.
( ) 70. Forty per cent of our tin is used for tin cans, which are made by covering steel with a layer of tin.
( ) 71. Copper is one of the recent metals brought out during the war.
( ) 72. Most of the world's copper is now mined in Chile, China, India, and England.
( ) 73. Copper over 99 per cent pure is made by the open hearth process.
( ) 74. Copper is a good conductor of electricity.
( ) 75. The green coating on telephone and telegraph transmission wires is painted on the wire to prevent corrosion.
( ) 76. Perhaps the most important use of copper is for making alloys.
( ) 77. Its ductility is high. It is possible to form a copper wire 1/1000 of an inch in diameter.
( ) 78. An alloy is a mixture of two or more metals while they are in a liquid state.
( ) 79. An alloy of a metal usually is softer than the pure metal.
( ) 80. The alloy usually melts at a higher temperature than one of its metals.
( ) 81. Many ancient swords were made of a mixture of nickel and iron.
( ) 82. German silver is an alloy of copper and zinc.
( ) 83. Brass is an alloy of copper, zinc, and nickel.
( ) 84. Monel metal is a stainless alloy of nickel.
( ) 85. Chromium is a comparatively new metal used extensively in the production of stainless alloys.
( ) 86. Vanadium has a low melting point.
( ) 87. Vanadium is widely used in the commercial field for armor plate.

( ) 88. Tungsten was first used in the incandescent lamp in 1904.
( ) 89. Most of the tungsten now used is obtained from Canada.
( ) 90. Molybdenum is a rare metal used for hardening steels.
( ) 91. Cobalt is a metal used to harden steel.
( ) 92. Manganese is an alloy found in Japan.
( ) 93. Titanium is used with manganese to make an alloy.
( ) 94. Metallurgy is a subject which can be mastered in a very short time.
( ) 95. In judging metal goods, little care need be given to workmanship as metal is tough and strong and should last forever.
( ) 96. In the manufacture of metal goods, safety must be given a great deal of consideration.
( ) 97. The alloy, known as white gold, contains nickel and gold.
( ) 98. The solder one uses in the shop is classified as a metal.
( ) 99. Solder contains both lead and tin.
( ) 100. Monel metal is widely used in the manufacture of kitchen sinks and refrigerators.

KEY

1. F	21. T	41. F	61. T	81. T
2. T	22. F	42. T	62. F	82. F
3. F	23. T	43. F	63. F	83. F
4. T	24. F	44. F	64. F	84. T
5. E	25. T	45. F	65. T	85. T
6. F	26. T	46. F	66. T	86. F
7. F	27. F	47. T	67. T	87. T
8. T	28. F	48. F	68. T	88. T
9. F	29. F	49. T	69. F	89. F
10. F	30. T	50. F	70. T	90. T
11. T	31. F	51. T	71. F	91. T
12. T	32. F	52. F	72. F	92. F
13. F	33. T	53. F	73. F	93. T
14. F	34. F	54. F	74. T	94. F
15. T	35. T	55. F	75. F	95. F
16. F	36. F	56. F	76. T	96. T
17. F	37. T	57. T	77. T	97. T
18. T	38. T	58. T	78. T	98. F
19. T	39. T	59. F	79. F	99. T
20. F	40. F	60. F	80. F	100. T

WOODWORKING TEST

E. R. GLAZENER
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Pearl River Junior College
Poplarville, Miss.

True-False

Directions: Read the following sentences carefully. If a statement is correct, place a *T* in the parentheses before the statement. If the statement is false, place an *F* in the parentheses.

( ) 1. Metal containers should be used for oily rags and waste.
( ) 2. After applying paste filler the surface of the board should be rubbed with the grain for best results.
( ) 3. The block plane is larger than the jack plane.
( ) 4. A nail is set below the surface with a countersink.
( ) 5. The rule is placed on its edge to make more accurate measurements.
( ) 6. White oak is a close grained wood.
( ) 7. Plane irons are ground to an angle of approximately 30 deg.
( ) 8. In most cases quartersawed lumber warps less than plain sawed lumber.
( ) 9. The steel square is used in place of the try square when squaring table tops and is used in the same manner as the try square.
( ) 10. The cap iron of a smooth plane is fastened to the flat side of the blade to act as a chip breaker.
( ) 11. In woodwork, rabbeting is a term used to denote the recessing of the edge of stock.
( ) 12. Plane irons and wood chisels are sharpened alike.
( ) 13. A handsaw is set about twice the thickness of the blade before filing.
( ) 14. A hole should be bored entirely through a piece of material with an auger bit without stopping.
( ) 15. The beauty of the grain of some woods may be brought out more clearly by using stain.
( ) 16. Oak is a soft wood.
( ) 17. A hack saw is used to cut thin wood.
( ) 18. A wood chisel is sharpened on both sides.
( ) 19. Before planing, the grain of the wood should be examined.
( ) 20. The best surface is selected as the working surface when squaring a board.
( ) 21. Furniture is stained after it has been shellacked.
( ) 22. Black walnut is an inexpensive wood for furniture making.
( ) 23. The ratchet brace is used when it is impossible to make a complete turn in boring a hole.
( ) 24. Animal glue, when heated, often becomes stronger.
( ) 25. A backsaw is used to cut metal.

Completion

Directions: Complete each statement correctly by supplying the missing word or words.

1. Always leave the plane on its ..... when not in use.
2. A ..... is a chamber artificially heated and used for drying large quantities of lumber.
3. Varnish is thinned with .....
4. ..... is the natural color of shellac.
5. The process of laying a thin sheet of expensive wood on a core or base of common woods is called .....
6. Three ways by which veneer may be cut from a log are ....., ..., and .....
7. The abbreviation ..... means surfaced on four sides; ..... means surfaced on one edge; and ..... means surfaced on two sides and one edge.
8. When pounding with a mallet is necessary, a ..... chisel should be used.
9. ..... are round pieces of wood used to assist in joining boards which are glued edge to edge.
10. An ..... bit is used to cut holes from ⅜ to 3 in. diameter in wood.
11. Dimensions for lumber are given in the following order: ....., ..., and .....
12. ..... is put on wood screws to make them enter the wood more easily.
13. The blade of the ..... plane is ground on the upper side.
14. The lead or pilot hole drilled for a screw should be ..... per cent of the core diameter in hardwoods and ..... per cent in softwoods for best results.
15. Three kinds of stains are ....., ..., and .....
16. To obtain a dull, polished effect on a project finished with varnish, the last coat may be rubbed with ..... and oil, and then rubbed with ..... stone and oil.
17. Nails are sold by the .....
18. Shellac is prepared by dissolving shellac flakes in .....
19. Paint and varnish brushes are cleaned with .....
20. The joint most commonly used in making a picture frame is the ..... joint.
21. Seven ply is the name of .....
22. 6*d* common would be the size of a .....
23. Before applying a finishing coat on open-grained wood, the pores would be closed with ....
24. We use a ..... to saw a board parallel with the grain.
25. Screws are commonly sold by the .....

Multiple-Choice

( ) 1. When planing the edge of a long board we use a (1) jack plane; (2) jointer plane; (3) smoothing plane; (4) block plane.
( ) 2. When squaring a board, begin first with the (1) edge; (2) end; (3) top; (4) surface.
( ) 3. The screw that would be naturally countersunk flush with the surface is the (1) roundhead; (2) fillister head; (3) flathead; (4) ovalhead.
( ) 4. Which of the following is best made from cedar: (1) dressers; (2) chest; (3) tables; (4) lamps?
( ) 5. The best plane for general use is the (1) smooth plane; (2) block plane; (3) jack plane; (4) circular plane.
( ) 6. The burr on a scraper is turned with a (1) file; (2) skew chisel; (3) paring chisel; (4) rasp; (5) burnisher.
( ) 7. The number on the shank of a wood auger bit indicates its size in (1) eighths; (2) sixteenths; (3) twenty-fourths; (4) thirty-seconds.
( ) 8. Number 4/0 sandpaper is classified as (1) fine; (2) coarse; (3) very coarse; (4) very fine.
( ) 9. Lumber is sold by the (1) board foot; (2) square foot; (3) cubic foot.
( ) 10. Which of the following is an expensive wood: (1) Basswood; (2) fir; (3) poplar; (4) mahogany?
( ) 11. Dividers are generally used for making (1) squares; (2) circles; (3) ellipse; (4) triangles.
( ) 12. Tool handles are best made from (1) basswood; (2) oak; (3) hickory; (4) bamboo.
( ) 13. Hinges for doors are called (1) butts; (2) strap hinges; (3) tie hinges; (4) butterfly hinges.
( ) 14. When sawing across the grain we use a (1) ripsaw; (2) coping saw; (3) block saw; (4) crosscut saw.
( ) 15. The frog is a part of a (1) plane; (2) spokeshave; (3) marking gauge; (4) hand drill.

KEY TO TESTS

True — False

1. T	6. F	11. T	16. F	21. F
2. F	7. T	12. T	17. F	23. T
3. F	8. T	13. F	18. F	22. F
4. F	9. T	14. F	19. T	24. F
5. T	10. T	15. T	20. T	25. F

Completion

1. side
2. kiln
3. turpentine
4. Orange
5. veneering
6. rotary
   sliced
   sawn
7. S4S
   S1E
   S2S1E
8. socket
9. Dowels
10. expansive
11. thickness
    width
    length
12. Soap
13. block
14. 90 per cent
    70 per cent
15. water
    oil
    spirit or acid
16. pumice
    rotten
17. pound
18. alcohol
19. turpentine
20. miter
21. Veneer
22. nail
23. wood filler
24. ripsaw
25. gross

Multiple — Choice

1. 2	4. 2	7. 2	10. 4	13. 1
2. 4	5. 3	8. 4	11. 2	14. 4
3. 3	6. 5	9. 1	12. 3	15. 1

A TEST ON DIMENSIONING PRACTICE

DELMAR W. OLSON

Southern Illinois Normal University

Carbondale, Ill.

This test on dimensioning practices has been compiled from the most common errors and malpractices appearing on students' drawings in the author's classes over a period of years. Only those which are generally applicable to mechanical drawing have been selected.

It has been found that the use of this test, accompanied by a discussion of the problems, has done much to prevent repetition of the errors on subsequent drawings.

Key to Dimensioning Test

Problem No.	*Answer*	*Remarks*
1.	B	Width of arrow head one third of length
2.	A	Leave space between extension and object line
3.	B	Extension line too long in A
4.	C	Preferred
5.	B	Finish symbol should read from bottom up
6.	B	Preferred
7.	C	Dimensions less than 72 inches are given in inches. No inch symbol used
8.	A	Finish symbol, 60 degrees
9.	B	Preferred
10.	A	Center of radius should be shown
11.	B	Extension line limit should be defined
12.	B	Put dimensions on view where they apply most clearly
13.	A	B is inaccurate
14.	B	A does not give thickness
15.	B	Give hole size by diameter (see No. 18)
16.	B	Preferred
17.	A	Center to center distances preferred on plan view
18.	B	Preferred
19.	B	Reduce fractions in dimensions
20.	B	Dimension lines not used as extension lines
21.	A	Evident
22.	B	Preferred
23.	A	Put over-all dimensions outside of detail dimension
24.	B	Do not dimension to hidden lines

TRUE-FALSE TEST FOR STUDENTS OF DRAFTING

C. H. SCHUBERT

Boys' Technical High School

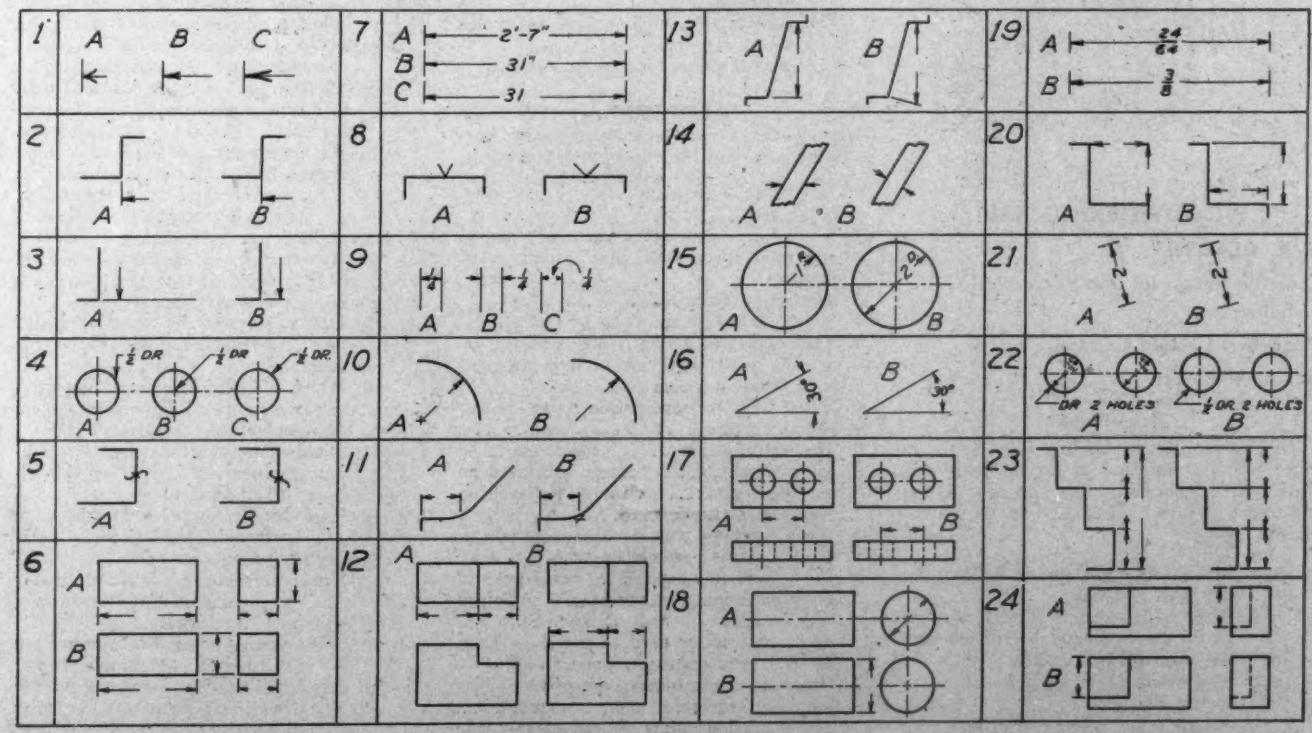
Milwaukee, Wis.

Directions: Read each statement carefully before you mark your answer. Some of the statements are true, some of the statements are false. If you think a statement is true, encircle the letter *T*. If you think a statement is false, encircle the letter *F*. Do not guess.

Example:

(T) F The ohm is the unit of resistance.

T F 1. Mechanical drawing is the language of industry.



A test on dimensioning practice

T F 2. Mechanical drawing does not develop the power of visualization.
T F 3. Mechanical drawing is an exact science of form and size description.
T F 4. It is not necessary for a mechanic to understand the fundamentals of mechanical drawing.
T F 5. A drawing board is made of softwood.
T F 6. A picture drawing of the object is usually made for the mechanic who is called upon to make the object.
T F 7. Cleats are fitted into the ends of the board to keep it from warping.
T F 8. The edge of the cleats must be perfectly straight.
T F 9. The working surface of the drawing board is smooth.
T F 10. The right-hand edge of the drawing board is called the working edge.
T F 11. The T square derives its name from its shape.
T F 12. The T square consists of three parts.
T F 13. The long thin piece is called the head.
T F 14. The short thick piece is called the blade.
T F 15. The blade and head of the T square are fastened at right angles.
T F 16. The lower edge of the T square is known as the working edge.
T F 17. The inside edge of the T-square head is known as the working edge of the head.
T F 18. The upper edge of the T-square blade must be perfectly straight.
T F 19. The inner edge of the T-square head must be absolutely true.
T F 20. A T square with a celluloid edged blade is inferior to one with a maple edged blade.
T F 21. All T squares are made 24 in. in length.
T F 22. The T square should never be used as a hammer for driving in thumbtacks.
T F 23. The head of the T square is held firmly against the left edge of the drawing board for drawing vertical lines.
T F 24. Drawing pencils are made hexagonal in shape because it is cheaper to make them that way.
T F 25. The T-square head is held firmly to the left working edge of the board when drawing horizontal lines.
T F 26. Horizontal lines are drawn along the upper edge of the T-square blade.
T F 27. Three triangles are always used in mechanical drawing.
T F 28. The triangles derive their name from their shape — three angles.
T F 29. The triangles commonly used in drafting are made of hardwood.
T F 30. The sum of all the angles of a triangle is 90 degrees.
T F 31. The 45-degree triangle is used to draw only horizontal lines.
T F 32. The 30–60 degree triangle is used to divide a circle into 12 equal parts.
T F 33. The 45-degree triangle is used to draw an octagon.
T F 34. The 45-degree triangle is used to divide a circle into 8 equal parts.
T F 35. The 45-degree triangle is an equilateral triangle.
T F 36. It is possible to draw a 15-degree angle by combining the 30–60 degree triangle with the 45-degree triangle.
T F 37. It is possible to draw a 75-degree angle by combining the 45-degree triangle with the 30–60 degree triangle.
T F 38. There are 90 degrees in a right angle.
T F 39. An acute angle is smaller than a right angle.
T F 40. An obtuse angle is larger than a right angle.
T F 41. Only the 30–60 degree triangle may be used to draw a vertical line.
T F 42. A right-angled triangle is a triangle having two right angles.
T F 43. An isosceles triangle is a triangle having 3 equal angles and three equal sides.
T F 44. An equilateral triangle is a triangle having two equal sides and two equal angles.
T F 45. A protractor is used for measuring or setting off angles other than those obtainable with the 30–60 degree or the 45-degree triangles.
T F 46. The erasing shield should be used to protect lines adjacent to the area to be erased.
T F 47. Thumbtacks are frequently used for holding paper to the drawing board.
T F 48. The head of the thumbtack should be rounded and rather thick to allow the T square and triangle to slide over it easily.
T F 49. Drafting tape is preferred by some draftsmen for fastening paper to the board, because the T square and triangles can slide over it easily.
T F 50. A good grade of drawing pencil properly sharpened is necessary for good work in mechanical drawing.
T F 51. A 4B drawing pencil is used for ruling pencil lines in mechanical drawing.
T F 52. A 2B drawing pencil is used for lettering and dimensioning.
T F 53. A 2H pencil should be used to brighten all lines on the finished pencil drawing.
T F 54. The unlettered end of the drawing pencil is sharpened to preserve the grade mark on the other end of the pencil.
T F 55. It is easy to identify a drawing pencil without a grade mark.
T F 56. A long conical point is preferred on the drawing pencil for all ordinary drafting work.
T F 57. The chisel point is used to pencil all letters and dimensions.
T F 58. The chisel point wears longer when ruling straight pencil lines than does the conical point.
T F 59. A horizontal line is one that is parallel to the horizon.
T F 60. Horizontal lines are ruled from left to right along the upper edge of the T-square blade.
T F 61. To draw a horizontal line place the T square along the top edge of the board and draw along the edge of the blade.
T F 62. The location points for horizontal lines should be marked off along the lower edge of the paper.
T F 63. A line drawn perpendicular to the horizon is a vertical line.
T F 64. Either triangle, set against the upper edge of the properly placed T square, may be used to draw vertical lines.
T F 65. A vertical line is drawn along the left edge of the triangle.
T F 66. The location points for vertical lines should be marked off along the left edge of the paper.
T F 67. The French curve is used for drawing curved lines, other than circles and arcs.
T F 68. A 12-in. civil engineer's scale is commonly used as a measuring device in mechanical drawing.
T F 69. Irregular curves can be bought in a variety of shapes and sizes.
T F 70. The irregular or French curve is often used to describe circles.
T F 71. When an object is too large to fit the drawing paper, it is drawn at a reduced scale.
T F 72. The next smaller scale to full size is quarter size or 3 in. equals 1 ft.
T F 73. A line 4¼ in. long drawn at half size will be 8½ in. long drawn at full size.
T F 74. Good lettering is most important as far as appearance of a drawing is concerned.
T F 75. The ability to letter well can be acquired through continued and diligent practice.
T F 76. All letters and numerals are made with the instruments.
T F 77. Guide lines are a necessary aid to good lettering and should be drawn very lightly.
T F 78. A ruling pen is used for lettering.
T F 79. The bar dividing a fraction is always drawn at an angle.
T F 80. The total height of the fraction should be 1 2/3 times the height of the whole number.
T F 81. Capital letters are known as upper case letters.
T F 82. All object lines are heavy full lines.
T F 83. All lines used in mechanical drawing have the same weight.
T F 84. Section lines are light full lines spaced evenly to give a shaded effect and are drawn at an angle of 45 degrees.
T F 85. Dotted lines are used to show invisible edges of the object.
T F 86. The extension line is the continuation of the object line.
T F 87. Every circle must have two center lines.
T F 88. The center line is used to indicate the center of a circle.

T F 89. A center line may be used as a dimension line.
T F 90. A center line extends a short distance beyond the object line.
T F 91. The pencil compass is used to draw pencil circles and arcs having radii of 1 in. or more.
T F 92. The shouldered needle point of the compass should be adjusted so that it is a little shorter than the pencil point or the pen attachment, if the latter is used.
T F 93. A circle is a curved line, every point on its circumference being equidistant from a given point within called the center.
T F 94. The distance around a circle is called the perimeter.
T F 95. The diameter of a circle is a straight line passing through its center from side to side.
T F 96. The radius of a circle is the distance from the center to the circumference.
T F 97. A straight line that touches a circle in one point only is a tangent.
T F 98. It is impossible for two circles to be tangent to each other.
T F 99. The dividers are used to transfer measurements and to divide a line into equal parts.
T F 100. All straight lines are inked with the ruling pen.

ANSWERS TO TRUE-FALSE EXERCISE

1. True	26. True	51. False	76. False
2. False	27. False	52. False	77. True
3. True	28. True	53. True	78. False
4. False	29. False	54. True	79. False
5. True	30. False	55. False	80. True
6. False	31. False	56. True	81. True
7. True	32. True	57. False	82. True
8. True	33. True	58. True	83. False
9. True	34. True	59. True	84. True
10. False	35. False	60. True	85. True
11. True	36. True	61. False	86. False
12. False	37. True	62. False	87. True
13. False	38. True	63. True	88. True
14. False	39. True	64. True	89. False
15. True	40. True	65. True	90. True
16. False	41. False	66. False	91. True
17. True	42. False	67. True	92. False
18. True	43. False	68. False	93. True
19. True	44. False	69. True	94. False
20. False	45. True	70. False	95. True
21. False	46. True	71. True	96. True
22. True	47. True	72. False	97. True
23. False	48. False	73. True	98. False
24. False	49. True	74. True	99. True
25. True	50. True	75. True	100. True

AIRCRAFT SHEET-METAL TEST

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I. Temper quality of metals are designated by letters. Tell what each of the following letters indicate:

1. H	6. SRT
2. ½H	7. W
3. ¾H	8. O
4. T	9. S
5. R	10. A

II. Fill in the blanks:

1. A combination of metals made from commercially pure aluminum and other metals is known as .....
2. The strong, lightweight metal produced from bauxite is .....
3. Aluminum alloy covered with a high purity aluminum is called .....
4. When metal becomes distorted with respect to its surface it is referred to as being .....
5. The ragged edge which results in grinding, cutting, or punching a piece of metal is called a .....
6. ..... is the rusting or oxidation of metal by chemical action.
7. A ..... is a curved surface joining two other surfaces.
8. When an edge is bent at an angle to a main surface of a piece of metal it is called a .....
9. Lightening holes and other round openings are cut in metal by a .....
10. A pointed instrument used to mark lines on metal is a .....
11. ..... is the force which produces rotation or twisting.
12. Small hand shears used for cutting sheet metal are called .....
13. A caliper is a device used to measure ..... or ..... dimensions.
14. ..... is the amount of leeway allowed over or above a dimension and is expressed by this symbol .....
15. The process of making an indentation around a rivet hole so that the rivet head will be flush with the metal surface is known as .....

III. Matching questions:

Directions: In each of the blanks write the correct letter.

( ) 1.	Designation for commercially pure aluminum.	A. camber
( ) 2.	The amount of curvature of an airfoil.	B. extrusion
( ) 3.	An open structural member whose cross section is U shaped.	C. aluminum alloy 24S
( ) 4.	The enclosed shelter which houses the power plant of an airplane.	D. gauge
( ) 5.	Wrought aluminum alloy developed for use in building aircraft.	E. C clamp
( ) 6.	The process of producing an object by forcing material through a hole having the desired size and shape.	F. nacelle
( ) 7.	The thickness of a piece of metal expressed in decimal or fractional parts of an inch.	G. clearance
( ) 8.	Any part used to make the edges of sheet metal firm.	H. channel
( ) 9.	The amount of clear space between two objects.	I. 2S
( ) 10.	A commonly used simple clamping device.	J. stiffener

IV. True-False. In each of the blanks write *T* if the statement is true and *F* if it is false.

( ) 1. Stakes are used for holding sheets of metal being countersunk.
( ) 2. A working drawing is a drawing or blueprint containing all the dimensions and instructions necessary to serve as a guide in construction or repair of a machine, structure, or part.
( ) 3. Applying a thin coat of solder to two metal surfaces is called spot welding.
( ) 4. The rearmost edge of a propeller blade is known as the trailing edge.
( ) 5. The sudden bulging of a metal surface is called planishing.
( ) 6. Smoothing, cleaning, and polishing a metal surface is called buffing.
( ) 7. The change that takes place in aluminum alloy after it has been heat-treated is referred to as aging.
( ) 8. A gusset is a reinforcement or brace used to strengthen the corner and strain points of a structure.
( ) 9. Flute is the shop name for a groove.
( ) 10. Hanger is the place where airplanes are stored.
( ) 11. Lightening holes are zigzag holes left in structural members so that static electricity does not interfere with the operation of the plane.
( ) 12. A strip or sheet of metal more than ⅛ in. thick is called a plate.
( ) 13. Swaging is the process of attaching sheet metal to fabric surfaces.
( ) 14. Heat-treating metals alters their physical properties.
( ) 15. Bauxite is a mineral clay consisting largely of aluminum hydroxide and is the principal source of aluminum.

V. Fill in the blanks with the correct word, words, or drawing:

1. Some hand hammers used in metalwork are:
   a) ..... *e*) .....
   b) ..... *f*) .....
   c) ..... *g*) .....
   d) ..... *h*) .....
2. Some common roll dies are:
   a) ..... *e*) .....
   b) ..... *f*) .....
   c) ..... *g*) .....
   d) .....
3. Two methods of preparing holes so that rivet heads will be flush with the surface are:
   a) ..... *b*) .....
4. Four common metal joints are:
   a) ..... *c*) .....
   b) ..... *d*) .....
5. Six metalworking punches are:
   a) ..... *d*) .....
   b) ..... *e*) .....
   c) ..... *f*) .....
6. Nine kinds of rivets used in metalwork are:
   a) ..... *f*) .....
   b) ..... *g*) .....
   c) ..... *h*) .....
   d) ..... *i*) .....
   e) .....
7. Draw the following seams:
   a) plain lap *c*) outside lap
   b) inside lap *d*) flange butt
   e) folded
8. Some common metalworking template abbreviations appear in the left column. Give their names in the blanks provided.
   a) AT .....
   b) BT .....
   c) CT .....
   d) DT .....

e) DJT .....
f) GT .....
g) MT .....
h) RT .....

KEY

I

1. full hard
2. one-half hard
3. three-fourths hard
4. heat-treated
5. strain hardened after heat-treatment
6. wrought alloy heat-treated and then strain hardened
7. heat-treated with less than maximum physical properties produced
8. full soft (fully annealed)
9. wrought
10. modification of basic composition

II

1. aluminum alloy
2. aluminum
3. Alclad
4. buckled
5. burr
6. corrosion
7. fillet
8. flange
9. hole saw
10. scriber
11. torque
12. snips
13. inside, outside
14. tolerance, ±
15. dimpling

III

1. I
2. A
3. H
4. F
5. C
6. B
7. D
8. J
9. G
10. E

IV

1. F
2. T
3. F
4. T
5. F
6. T
7. T
8. T
9. T
10. F
11. F
12. T
13. F
14. T
15. T

V

1. *a*) ball-peen
   b) cross-peen
   c) riveting
   d) setting
   e) bumping
   f) raising
   g) dinging
   h) planishing
2. *a*) straight crimping
   b) elbow (various shapes)
   c) burring
   d) single bead
   e) turning
   f) ogee
   g) pitch crimping
3. *a*) countersinking
   b) dimpling
4. *a*) butt joint
   b) flange butt joint
   c) riveted butt joint
   d) lap joint
5. *a*) center punch
   b) solid punch
   c) transfer punch
   d) prick punch
   e) pin punch
   f) hollow punch
6. *a*) brazier head
   b) flathead
   c) mushroom head
   d) roundhead
   e) split
   f) Rivnut
   g) cherry type
   h) Iseman type
   i) explosive
7. *a*. *b*. *c*. *d*. *e*.
8. *a*) angle template
   b) block template
   c) contour template
   d) drill template
   e) drill jig template
   f) gauge template
   g) marking template
   h) router template

ARCHITECTURAL DRAFTING TEST

W. H. BOWERS
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Name..... Date..... Score....

One hundred statements follow. Read each one carefully. If the statement is true place a *T* before it. If it is false place an *F* before it.

Deduct 1.5 per cent for each one answered incorrectly. Enter your score, date, and name above.

( ) 1. Mechanical drawing devoted to building representation is called structural drafting.
( ) 2. A building is erected to accord with the ideas of the chief draftsman and his assistants.
( ) 3. The architect usually draws up the plans, in all details, on his drawing board.
( ) 4. The architect is usually a college graduate.
( ) 5. The lettering on an architectural drawing is drawn at a sixty degree angle.
( ) 6. State Teachers College, at Oswego, N. Y., is known nationally because of the five architects who have been graduated from there.
( ) 7. Personality, imagination, intellect, and a love for the sciences are necessary to become a successful architect.
( ) 8. A graduate architect works as an assistant before he goes into business for himself.
( ) 9. Surveyors, carpenters, electricians, plumbers, sheet-metal workers, and appraisers use architectural drawings.
( ) 10. A roof framing plan is always included in the architect's directions.
( ) 11. East, west, north, and south elevations are drawn to the scale of three inches to a foot.
( ) 12. A floor plan is a top view of the floor represented.
( ) 13. Built-in furniture and fixtures, plumbing and heating outlets are included in a floor plan.
( ) 14. Floor plans are generally drawn to the scale of one quarter inch to a foot.
( ) 15. Details are represented with symbols, excepting the doors and windows.
( ) 16. Dimensions of window glass and plumbing fixtures are expressed in inches only.
( ) 17. Small houses, or cottages are usually supported by wood units.
( ) 18. Footings and walls up to the first floor joists are known as the foundations.
( ) 19. Walls and piers should extend above the ground level.
( ) 20. Screened openings should be provided equal in area to about 35 per cent of the ground coverage of the house.
( ) 21. The best site for a country house is on level ground.
( ) 22. A slab foundation is best suited to a severe climate, where frosts are of constant occurrence.
( ) 23. In a wooden house the floor is supported by joists.
( ) 24. Floor joists are usually of 3-in. planks.
( ) 25. Floor joists are screwed to the sill plate.
( ) 26. The sill plate is fastened to the wall with bolts.
( ) 27. Floor joists are usually 14 in. in width.
( ) 28. A girder runs the full length of the building.
( ) 29. The girder is supported by piers.
( ) 30. Both metal and wood piers are used to support the girders.
( ) 31. Piers are usually of heavy iron material.
( ) 32. A girder of concrete is used to support a superstructure.
( ) 33. Cross bridging is usually ¾ by 3 in. nailed crosswise between the joists.
( ) 34. Solid bridging should be used between joists directly above the girder.
( ) 35. Proper bridging should be made of good material, well fitted and well nailed.
( ) 36. Bridging ties the floor into one solid structural unit.
( ) 37. In frame construction the upright members are of 2 by 8-in. lumber.
( ) 38. These pieces are called *studs* and are spaced 18 in. on centers.
( ) 39. Narrow boards, 4 in. wide, are used, called sheathing to form a foundation for the outer surface covering of the side walls.
( ) 40. Sheathing is used to cover a roof.
( ) 41. Lath and plaster are on the inside of the *studs*.
( ) 42. Partitions are often covered with wallboard on one side of the *studs*.
( ) 43. Walls and partitions are represented as 8 in. thick in frame houses.
( ) 44. In nonsupporting partitions, the 2 by 4-in. studs are sometimes set flat, rather than crosswise.
( ) 45. The members forming the framework of the roof are called rafters.
( ) 46. A rafter is usually 4 in. thick in a frame house.
( ) 47. The lower ends of rafters are notched to form a seat and rest on the wall plate.
( ) 48. A rafter is screwed to the wall plate.
( ) 49. Opposing rafters are set across from each other, the upper ends being screwed to the ridge board.
( ) 50. The ceiling joists are securely nailed to the rafters and serve as ties.
( ) 51. Rafters are usually covered with 1-in. boards, 6 to 8 in. wide.
( ) 52. When a roof is to be covered with wood shingles a space for air is left between the boards.
( ) 53. Plywood is never used for roof sheathing.
( ) 54. The amount of shingle exposed to the weather depends upon the slope of the roof and the length of the shingles.
( ) 55. Roofing paper assists in keeping out dust and water, also heat and cold.
( ) 56. The slope of a roof should always be 45 degrees.
( ) 57. A *scuttle* is provided in the roof to afford protection to the rooms below against summer heat.
( ) 58. The attic of a frame house should be ventailated with screened *louvers*.
( ) 59. The highest horizontal timber in a roof is called a ridge pole.
( ) 60. Any roof whose rafters meet in an apex is called a ridge roof.
( ) 61. The term used to indicate the degree of incline of a roof is called rise.
( ) 62. All masonry chimneys should be lined with asbestos.
( ) 63. Chimneys should rest on separate footings built on solid ground.
( ) 64. All chimneys should extend not less than 6 inches above the highest ridge of the house.

( ) 65. At the top of a chimney there should be a concrete cap, 1½ in. thick, with the top beveled to shed water.
( ) 66. No woodwork should be placed nearer than 1 in. to any chimney.
( ) 67. The top surface of all *drip caps* should be covered with fiberboard.
( ) 68. Flashing is used to lead water away at the junction of different parts of a building.
( ) 69. Flashing is usually provided along the ridge of pitched roofs.
( ) 70. Chimneys, where they pass through the roof, must be flashed with plywood.
( ) 71. Sheet-metal shields are placed over the top of foundation walls and piers in order to prevent termite infiltration.
( ) 72. Moldings are used only for the purpose of protecting corners or cover joints.
( ) 73. Outside trim is usually made of concrete or light iron.
( ) 74. *Beveled siding* is used as a side wall covering.
( ) 75. *Beveled siding* is lid overlapping, the lap varying with the width.
( ) 76. Wood siding is usually made of maple or birch.
( ) 77. Crown moldings are used for decorative purposes and to hide unsightly joints between two parts of a building.
( ) 78. Crown molds are never used as inside trim.
( ) 79. *Drip caps* are exterior moldings used above windows and doors to prevent water from running.
( ) 80. The boards or moldings around the top and sides of a door or window frame are called the *apron*.
( ) 81. The window ledge is called the *stop*.
( ) 82. The "base" is the covering at the junction of side walls and floor.
( ) 83. Interior trim, exterior moldings, windows, doors, and other units are offered by manufacturers in many well-designed forms.
( ) 84. In small scale drawings of elevations standard units are drawn to their approximate shapes.
( ) 85. Standard units when represented in separate detail drawings are drawn to a very small scale.
( ) 86. A glass window pane is called a *light*.
( ) 87. The frame that holds the lights is called the *sash*.
( ) 88. Casement windows have a single sash hinged on the top.
( ) 89. Many architects consider the entire glass in one sash as one light, even though it is divided.
( ) 90. Double hung windows balance themselves.
( ) 91. Prefit storm sash and screens may be purchased as part of a unit.
( ) 92. Spring balanced windows require more space between them than weight balanced windows.
( ) 93. Exterior doors are generally 3 in. thick by 2 ft. 8 in. and 7 ft. high.
( ) 94. Inside doors are usually 2 in. thick by 2 ft. 8 in. and 6 ft. 8 in. in height.
( ) 95. Interior doors are furnished in narrow sizes for small closets.
( ) 96. Doors with glass lights in them are said to be *glazed*.
( ) 97. Insulation materials may be bought from your local dealer.
( ) 98. The flat portion of a step is called a *tread*.
( ) 99. A built up framework of hexagonal units for supporting loads over long spans is called a *truss*.
( ) 100. A successful architect during normal or good times is a very well-paid member of society.

KEY

1. F	26. T	51. T	76. F
2. F	27. F	52. T	77. T
3. T	28. T	53. F	78. F
4. F	29. T	54. T	79. T
5. F	30. T	55. T	80. F
6. F	31. F	56. F	81. F
7. T	32. F	57. F	82. T
8. T	33. F	58. T	83. T
9. T	34. T	59. T	84. T
10. F	35. T	60. T	85. F
11. F	36. T	61. T	86. T
12. T	37. F	62. F	87. T
13. T	38. F	63. T	88. F
14. T	39. F	64. F	89. T
15. F	40. T	65. F	90. F
16. T	41. T	66. F	91. T
17. F	42. F	67. F	92. F
18. T	43. F	68. T	93. F
19. T	44. T	69. T	94. F.
20. T	45. T	70. F	95. T
21. F	46. F	71. T	96. T
22. F	47. T	72. F	97. T
23. T	48. F	73. F	98. T
24. F	49. F	74. T	99. F
25. F	50. T	75. T	100. T

END-TERM TEST FOR INDUSTRIAL-ARTS SHEET METAL WORK

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General Directions

The purpose of this test is to see how much you understand of the general information, materials, tools, operations, and processes in sheet metal work. There are five parts: true-false, matching, sentence completion, problem solving, and multiple choice. Think over each question carefully but do not spend too much time on any one question.

PART I — Related Work

Directions: This part of the test is made up of true and false statements. If you are convinced a statement is true, place a *T* in the parentheses before the statement. If you are convinced a statement is false, place an *F* in the parentheses. *Do not guess.* The examination will be corrected for guessing. A sample statement is given for your guidance.

Sample: (F) A scratch awl is a hammer.

( ) 1. Sweating is a type of soldering.
( ) 2. Slight cuts or bruises do not require first aid attention.
( ) 3. Chisels used in sheet metal work are usually cold chisels.
( ) 4. The diameters of twist drills are punched on the tang.
( ) 5. The file is a cutting tool and is very good for taking off sharp edges on tin plate.
( ) 6. It is a well-known fact that if a flux works well on galvanized iron it can he used on all sheet metals.
( ) 7. Galvanized iron and tin plate are hard to tell apart.
( ) 8. To get an accurate measurement with the dividers, the point of one leg is to be placed on the inch mark of the scale and the other leg point should fit in the groove of the desired fraction of the inch.
( ) 9. If the gauge of a piece of sheet metal is too thick to be cut with the snips, the bench shears or a flat chisel can be used.
( ) 10. If the pupil does not want scratches to appear on the metal, he may use a pattern made of cardboard.
( ) 11. When laying out several parallel lines on metal, measure carefully from each one as it is drawn.
( ) 12. The three forms of development in use are parallel line, radial, and a combination of both.
( ) 13. To get accurate measurements with the steel rule, rest it flat rather than on edge and then mark off the dimentions.
( ) 14. A pencil is not used on sheet metal as the mark is easily rubbed off.
( ) 15. Mallets are used extensively on shaping and forming sheet metal objects because they do not dent or mar the material.
( ) 16. A rivet may be improvised from a piece of wire used in wire seaming.
( ) 17. If a rivet hole is made too large it may be made smaller by resting the sheet metal on a stake and pounding it with a mallet.
( ) 18. The rivet set is made in one size.
( ) 19. The guard on the blade of the squaring shears insures the safety of the fingers.
( ) 20. Burred edges on a butt seam are desirable because they offer more surface and better joining with solder.
( ) 21. A joint need not fit snugly before soldering because the solder will close it and make it waterproof.
( ) 22. Although the metalworking industry has many phases, it really is not an important one.
( ) 23. A left-handed person should hold the sheet metal in the right hand and the snips in the left.
( ) 24. When cutting with the snips, the cutting edges should be placed on the line of the pattern to be cut out.
( ) 25. Snips are also used to cut nails, screws, and wire.
( ) 26. Tacking is a soldering process whereby small blobs of hot solder are placed at intervals on the seam to be strengthened.
( ) 27. A stake for the sheet metal worker serves the same function as an anvil for the forger.
( ) 28. The wooden rule is just as accurate a measuring instrument as the steel rule because both are based on the standard inch.
( ) 29. The soldering copper is allowed to get hot so that it can form an oxide or dross which is very useful in soldering.
( ) 30. Pure tin resists rust.
( ) 31. Galvanized iron is zinc covered black iron.
( ) 32. The plan of a funnel is obtained by parallel line development.

( ) 33. The thicknesses of sheet metal are measured with an adjustable gauge.
( ) 34. A cold chisel with a mushroomed head can be used with comparative safety.
( ) 35. Sheet iron coated with tin may be called tin plate.
( ) 36. To properly heat a soldering copper, the point must be placed in the flame.
( ) 37. Joints in sheet metal are made, in the main, by overlapping edges or folding them to form seams that interlock.
( ) 38. Seams are soldered to make them watertight.
( ) 39. The grooved seam on the body of a funnel is soldered on the inside.
( ) 40. The first fold of a double edge is slightly larger than the second.
( ) 41. To close the rim of metal snugly and evenly around a wire, run the edge through the wiring machine.
( ) 42. To find the circumference of a circle multiply the diameter by 3.1416 or: circumference equals $\pi \times D$, or better still, use the circumference rule.
( ) 43. The purpose of the dipping solution used in soldering is to remove the coat of solder from the soldering copper.
( ) 44. In laying out a circle, the dividers are adjusted to the necessary diameter.
( ) 45. When working with small, light work where gripping and bending cannot be done on machines, the pliers may be used.
( ) 46. Ordinarily, tin plate is packed in boxes of 112 or 225 sheets.
( ) 47. In making an article with a wire edge, the pupil should allow on light gauge metal, about three times the diameter of the wire being used.
( ) 48. The point of the soldering iron, rather than the side, should rest on the seam to be soldered because it has a higher concentration of heat.
( ) 49. A seam joint is always soldered on the inside.
( ) 50. The most common form of rivet is the cone head.

KEY

Part I — Related Work

1. T	11. F	21. F	31. T	41. T
2. F	12. T	22. F	32. F	42. T
3. T	13. F	23. T	33. F	43. F
4. F	14. F	24. T	34. F	44. F
5. T	15. T	25. F	35. T	45. T
6. F	16. T	26. T	36. F	46. T
7. F	17. T	27. T	37. T	47. T
8. T	18. F	28. F	38. T	48. F
9. T	19. F	29. F	39. T	49. T
10. T	20. T	30. T	40. F	50. F

PART II — Matching

Directions: In the right-hand column in this part of the test will be found pictures of various objects used in sheet metal work. Each one is labeled with a number. In the left-hand column there is a blank space with a corresponding number. Write the full and correct name of each object next to this number in the space provided. Be as clear and specific as you can. You will receive one point for each correct name and one half point if part of the name is omitted. A sample statement is given for your guidance.

(See Illustration on page 76)

KEY

Part II — Matching

1. Straight snips
2. Bench plate
3. Rivet set
4. Combination square
5. Needle case stake
6. Double hem
7. Twist drill
8. Blowhorn stake
9. Bench shears
10. End cutting nipper
11. Hollow mandrel stake
12. Brake
13. Hawk's bill snips
14. Hollow punch
15. Gas furnace
16. Adjustable bar folder
17. Slip roll forming machine
18. Squaring shears
19. Steel square
20. C clamp
21. Mallet
22. Rivet hammer
23. Spring divider
24. Round head (or button head) rivet
25. Machinist's vise
26. Cold chisel
27. Hand file
28. Center punch
29. Compass
30. File card
31. Candle mold stake
32. Hand groover

PART III — Sentence Completion

Directions: The statements that follow are not complete and require one or more words to become a whole sentence. Fill in the blank space which will be found at the end of the sentence with the required word or words. One point will be allowed for each correct statement. A sample statement is given for your guidance.

Sample: 1. Soft solder consists of lead and *tin*..

1. The common flux used for soldering is ....
2. Turning an edge on a disk is done on the ....
3. A pivoter is a type of .....
4. The type of development employed in work on patterns for buckets and similar conical forms is .....
5. When punching circles out of sheet metal with the hollow or solid punches, the work should be placed on the end grain of a piece of hardwood or on a .....
6. The tool used for cutting small sizes of wire is the ....
7. In light work, the diameter of a rivet to be set should usually not exceed .... of an inch.
8. Three means of joining pieces of sheet metal are ....
9. The tool one would use in soldering the base of a can to the body would be the ....
10. Mention three or more sheet metals besides tin plate, sheet zinc, and copper ....
11. Metal sheets more than one fourth of an inch thick are called .....
12. Zinc, cast into slabs when taken from the furnace, is known as .....
13. The color of tin plate is ....
14. Wire of a diameter of one eighth inch or more can be severed with the ....

KEY

Part III — Sentence Completion

1. zinc chloride
2. burring machine
3. snips
4. radial
5. lead cake, or, lead block
6. side cutting pliers
7. one sixteenth
8. soldering, riveting, seaming
9. bottoming copper
10. brass, pewter, aluminum, galvanized iron, German silver, monel, nickel silver, steel
11. plates
12. spelter
13. silvery white, or (similar to aluminum)
14. Hack saw

PART IV — Multiple Choice Questions

Directions: This test consists of ten statements. Following each are a number of choices from which you are to select the one you believe correctly completes it, and place its letter in the parentheses at the left of the statement. A sample is given for your guidance.

Sample:

(*c*) 1. Fifty-fifty solder is made of: (*a*) lead and aluminum, (*b*) tin and aluminum, (*c*) lead and tin.

( ) 1. The spout of a funnel is best formed on the (*a*) solid mandrel stake, (*b*) conductor stake, (*c*) hatchet stake, (*d*) mushroom stake, (*e*) candle mold stake.
( ) 2. A wire edge is put on an object to (*a*) make it look better, (*b*) aid in painting it, (*c*) strengthen it, (*d*) do away with the sharp edge, (*e*) avoid notching.
( ) 3. A good substitute for a rivet is (*a*) a ten penny nail, (*b*) a small bolt, (*c*) a machinist's screw, (*d*) an escutcheon pin, (*e*) a brad.
( ) 4. To remove the scale of sheet metal made by the hot rolled process, it is generally dipped in a pickle bath of (*a*) sulphuric acid, (*b*) nitric acid, (*c*) hydrochloric acid, (*d*) picric acid, (*e*) acetic acid.
( ) 5. Sheets of tin plate possessing a light coating of tin are known as (*a*) cakes, (*b*) cokes, (*c*) pigs, (*d*) blooms, (*e*) slabs, (*f*) biscuits, (*g*) ingots.
( ) 6. Before any project can be made, the worker must first make a (*a*) templet, (*b*) sample, (*c*) model, (*d*) layout, (*e*) transition.
( ) 7. Pewter is closely allied to (*a*) solder, (*b*) bauxite, (*c*) bronze, (*d*) aluminum, (*e*) monel metal.
( ) 8. The parts of the tinner's snips that do the cutting are called the (*a*) jaws, (*b*) faces, (*c*) sides, (*d*) blades, (*e*) shears.
( ) 9. A joint that is soldered directly edge to edge is a (*a*) hem, (*b*) seam, (*c*) butt, (*d*) lap, (*e*) offset, (*f*) single edge.
( ) 10. Excess solder may be removed from the soldering copper in the process of soldering by a (*a*) file, (*b*) quick brush of wet fingers, (*c*) rapid motion, dropping the unwanted solder on the floor, (*d*) shave hook, (*e*) damp rag, (*f*) sky hook.

KEY

Part IV — Multiple Choice Questions

1. (*e*)	3. (*d*)	5. (*b*)	7. (*a*)	9. (*c*)
2. (*c*)	4. (*a*)	6. (*d*)	8. (*d*)	10. (*e*)

PART V — Problem Solving

Directions: The statements relating to each of the problems that follow are not in their correct order. You are to rearrange each statement so that it correctly follows the other in doing the particular job right. One point will be deducted for each statement out of its proper place. No credit will be deducted if the other statements rightly follow each other if thrown out of procedure by one wrong placement. Place the number of each sentence in correct order in the parentheses provided for it in the left-hand column. A sample is given for your guidance.

(Turn to page 77)

SAMPLE

1 Straight Snips 1

2 _____ 2

3 _____ 3

4 _____ 4

5 _____ 5

6 _____ 6

7 _____ 7

8 _____ 8

9 _____ 9

10 _____ 10

11 _____ 11

12 _____ 12

13 _____ 13

14 _____ 14

15 _____ 15

16 _____ 16

17 _____ 17

18 _____ 18

19 _____ 19

20 _____ 20

21 _____ 21

22 _____ 22

23 _____ 23

24 _____ 24

25 _____ 25

26 _____ 26

27 _____ 27

28 _____ 28

29 _____ 29

30 _____ 30

31 _____ 31

32 _____ 32

This is the illustration in Part II — Matching Test, page 75

(Continued from page 75)

Sample: Problem — Cutting a Circle From Sheet Metal

(2) 1. Cut out with snips.
(3) 2. Adjust dividers for desired size.
(1) 3. Scribe circle on metal with dividers.

Problem I — Manufacturing of Tin Plate

( ) 1. Coated sheets are passed between smooth steel rolls running in oil.
( ) 2. Sheets of iron pass through a flux and are immersed in molten tin.
( ) 3. Coated sheets are passed through the finishing rolls.
( ) 4. Sheets of iron are pickled and cleaned.
( ) 5. Final cleaning and polishing.

Problem II — Tinning a Soldering Copper

( ) 1. Melt solder against copper so that it will run on sal ammoniac cake.
( ) 2. Round point of soldering copper and file off sharp corners.
( ) 3. Heat soldering copper to dull red color.
( ) 4. Brighten tinned copper in dipping solution.
( ) 5. File faces of point until bright clean copper appears.
( ) 6. First dipping in dipping solution.
( ) 7. Rub copper on sal ammoniac cake.

Problem III — Sweating a Lap Joint

( ) 1. Remove excess solder.
( ) 2. Slowly move heated soldering copper along joint.
( ) 3. Clean edges of tin plate with flux.
( ) 4. Test the strength of the joint.
( ) 5. Tin edges of sheet metal to be sweated.

Problem IV — Making a Rivet Joint

( ) 1. Place cup of rivet set on point and form it into a head.
( ) 2. Hit metal with a mallet until imprint of rivet appears.
( ) 3. Place hole in end of rivet set over rivet imprint on metal and strike with hammer until rivet cuts through.
( ) 4. Set pieces of metal with center-punched holes over rivet.
( ) 5. Rest head of rivet on square stake.
( ) 6. Center punch small holes in metal where rivet is to pierce.

Problem V — Fastening a Tin-Plate Bottom to a Body With a Double Seam as in a Cup

( ) 1. Turn burr on bottom.
( ) 2. Solder.
( ) 3. Make joint on body and turn edge.
( ) 4. Place body in bottom.
( ) 5. Lay out stock for body, allowing for joint.
( ) 6. Lay out and cut stock for bottom.
( ) 7. Set bottom with setting down hammer.

Problem VI — Forming a Wire Edge on Small Pail With the Wiring Machine

( ) 1. Shape wire into a circle on forming rolls.
( ) 2. Set edge with wiring machine.
( ) 3. Turn top edge of pail on turning machine for the wire.
( ) 4. Cut wire to correct length.
( ) 5. Tap edge of pail over wire with mallet.
( ) 6. Choose desired diameter of wire to be used.

KEY

Part V — Problem Solving

Problem I	*Problem II*	*Problem III*	*Problem IV*	*Problem V*	*Problem VI*
(4)	(3)	(3)	(6)	(5)	(3)
(2)	(5)	(5)	(5)	(3)	(6)
(1)	(2)	(2)	(4)	(6)	(4)
(3)	(6)	(1)	(2)	(1)	(1)
(5)	(7)	(4)	(3)	(4)	(5)
	(1)		(1)	(7)	(2)
	(4)			(2)	

RULES FOR SCORING

			Score
50	Part I	True and false questions....	——
31	Part II	Matching	——
18	Part III	Sentence completion	——
10	Part IV	Multiple choice questions....	——
36	Part V	Problem solving or procedure.	——
145			

Rules for scoring:

Highest possible score is 145. This will hardly be obtained as the author must admit that a number of questions have been included to reach a ceiling, yet every item is within the ken of those being tested; 145 will equal 100 per cent. One point is deducted for each error; in some cases one half point as in matching, where part of an answer may be forthcoming.

In true-false questions, deduct two points for each wrong answer.

Time: The test may be administered over two or three periods or until such time as the majority of pupils finish it.

As this is a teacher-made examination, the teacher may use the obtained score as the final grade or take into consideration the work of the pupil as a whole. The writer suggests the adoption of the former procedure, that is, accept the objective score but give a performance test if he is not entirely positive of the capabilities of his pupils. In this way he may come to a just conclusion — entire objective — in both manual skills and knowledges.

Problems and Projects

ALUMINUM BARRETTE, BANDEAU, AND BRACELET

DOUGLAS B. HOBBS
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Bill of Material

Barrette
1 piece, 14 B & S gauge (0.064 in.) by 1⅜ by 3⅛ in., 52S–½H aluminum alloy sheet
1 piece, 14 B & S gauge (0.064 in.) by 3/16 by 4⅜ in., 52S–½H aluminum alloy sheet

Bandeau
1 piece, 14 B & S gauge (0.064 in.) by ⅜ by 11⅝ in., 52S–½H aluminum alloy sheet

Bracelet
1 piece, 14 B & S gauge (0.064 in.) by ½ by 6 in., 52S–½H aluminum alloy sheet

The making of barrettes, bandeaux, and bracelets gives the junior high school industrial-arts student an opportunity to learn through practice a number of the fundamental metalworking operations. These include: layout, sawing and filing, forming, and finishing.

For hair ornaments and bracelets in aluminum, Alcoa 52S–½H alloy sheet in 14 B & S gauge (0.064 in.) is suggested. The alloy containing as it does magnesium and chromium, possesses excellent machining characteristics and has sufficient springiness to make it ideally suited for such projects. The alloy, too, may be easily and attractively finished.

Fig. 3. Aluminum braclet and bandeau

In doing fine work with aluminum, as with other metals, it is well to cover the sheet with paper to prevent marring the surface during the sawing and filing operations. Scotch tape is fine for this purpose, or a fairly heavy paper may be applied to the surface by means of a pyroxylin adhesive.

Lay out the design on the paper covered stock with pencil. Saw to within 1/32 in. of the finished dimension line, never on the line, and then file to the line. This practice in sawing should be stressed. If a student saws on the line, it means that after filing to finish off the rough edges the piece will be undersize. The scroll saw should be equipped with a jeweler's saw blade having more teeth per inch than the gauge number of the sheet being sawed. In this case, the saw blade should have more than 14 teeth per inch.

In filing, use a single-cut, bastard file—never a double-cut file. Hold the piece in the jaws of a vise when filing. The jaws should be covered with scrap aluminum sheet to prevent the teeth from biting through the paper covering the stock and marring it. After the barrette, bandeau, or bracelet has been filed to the finished dimension lines, remove the protective paper covering. The removal of Scotch tape presents no problem. Paper applied to the sheet with a pyroxylin adhesive can easily be removed by immersing the piece in acetone.

The barrette, bandeau, and bracelet blanks should be finished before forming. Three

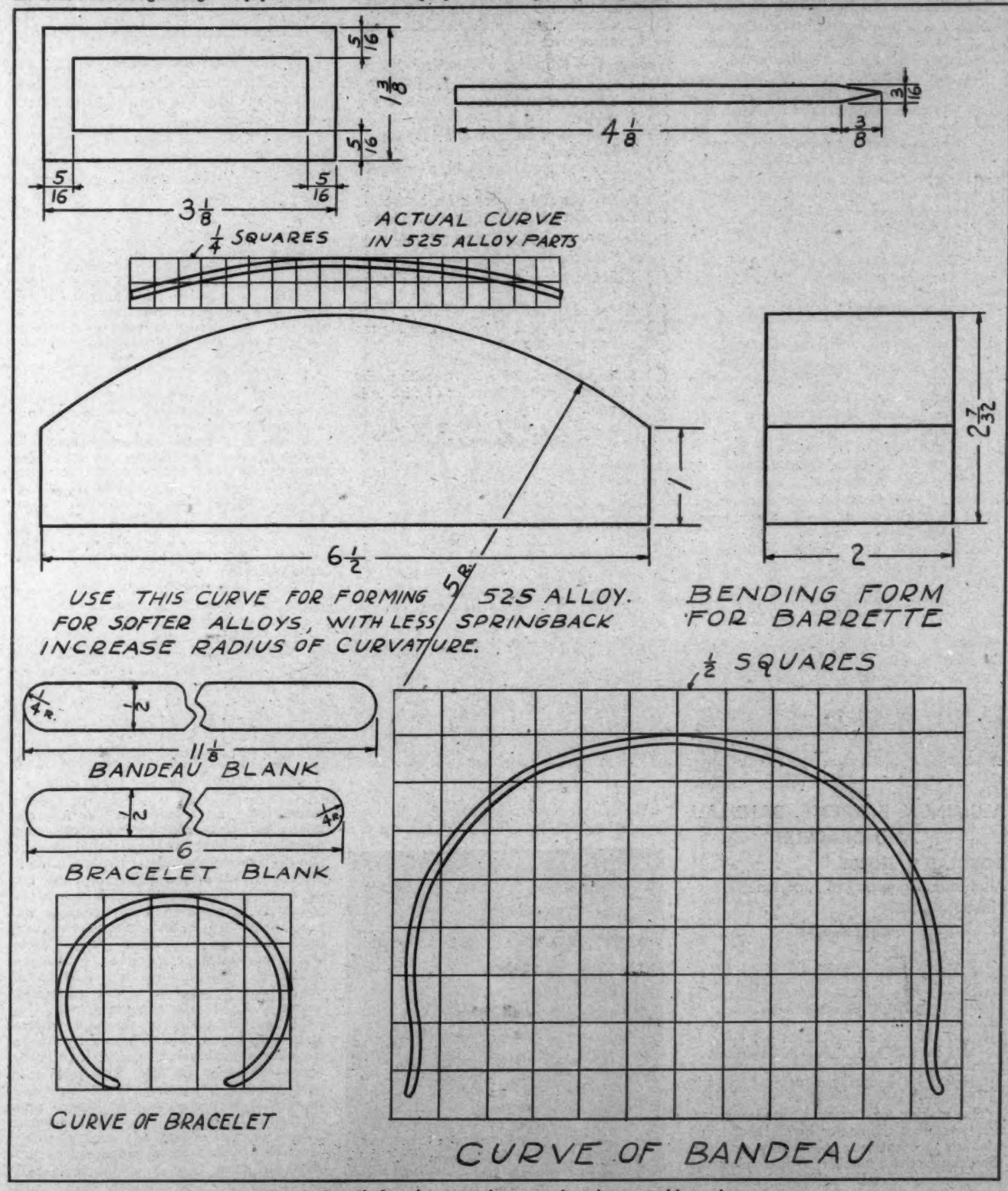

Fig. 4. Details for aluminum barrette, bandeau, and bracelet

finishes are suggested: satin, polished, and hand hammered.

The satin finish is the easiest to apply. It merely consists of rubbing the aluminum surface with No. 3/0 steel wool and furniture wax.

The polished finish is obtained by the action of polishing wheels rotating at comparatively high speeds against the surface of the metal. The polishing wheels are composed of muslin disks. For the first polishing operation, sewed muslin disks should be used with Tripoli powder in a grease binder. For the final polishing operation, unsewed muslin disks should be used and the abrasive should consist of lime or soft silica in a grease binder. The binder in both cases may be tallow, beeswax, stearic acid, paraffin, or petrolatum. The wheels should operate with a peripheral speed of 7000 to 7500 feet per minute.

Hand hammering is accomplished by hammering the surface of the sheet with the ball-peen end of a ball-peen hammer while the sheet is resting on a piece of hard rubber. The hard rubber keeps the undersurface from becoming damaged. Different effects can be obtained with different weight hammers. For the hair ornaments and bracelets described in this article, a two-ounce hammer will give a very pleasing finish. In hammering, care should be exercised to see that the hammer marks overlap and cover the entire surface. This is important for a poor effect is obtained when the hammer marks are scattered and smooth surfaces of sheet remain. Hammering will cause the sheet to bow and become harder. It is necessary to straighten the sheet metal blanks before forming and this is accomplished by hammering the material on the underside with a rawhide mallet while holding the sheet over a piece of soft wood. Or, the hammered blank may be held between two pieces of softwood and squeezed tightly in a vise.

To form the two parts of the barrette, make a hardwood form such as that shown in Figure 4. With a piece of paper covering the top of

Fig. 1. Aluminum barrette and bracelet

Fig. 2. Aluminum bandeaux, bracelets, and barrettes

the barrette blanks, hammer them over the form with a rawhide mallet. Because of the springback in the aluminum alloy used, the blanks will not take on the contour of the form but will have a radius somewhat greater. This is quite all right as the form has been designed for the springback in the material. The ends of the bandeau may be bent in a vise and the remainder by hand. The bracelet blanks may also be bent by hand. Alloy 52S-½H does not bend as easily as some of the softer aluminum alloys. For this reason, it may prove easier to bend the bandeau and bracelet blanks by hand but between two metal rods held in an upright position in a vise. The rods should be approximately ¼ in. in diameter and be spaced about ⅛ in. apart. Regardless of whether the blanks are bent entirely by hand or with the aid of rods in a vise, the blanks should be checked against a full-sized layout as bending progresses. It may be necessary in the case of the bandeau to make changes in its shape to fit the head of the one for whom it is intended.

JUSTIFICATION OF HANDWORK

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When we find a subject in which the simple mechanical principles, the lever, the pulley, the wheel and axle, the inclined plane, the wedge, and the screw are applied, we feel that this subject is worthy of great consideration.

The background of industrial arts, crafts, handwork in general, or whatever title under which it now appears has always interested me because it provides facts that form a fascinating story.

If we go back to the year 2000 B.C., we find the Jewish youth going to school one-half day to learn the law, and the other half to learn a trade.

We know that the Christ Child was taught the carpenter trade by His father. In the early monastic schools, much emphasis was placed on handwork.

During the late sixteenth and the early seventeenth centuries Comenius found that the constructive and destructive instincts in children were the same, and it was he who was responsible for putting handwork into primary education at that time. In this field we also find Rousseau (1712–78), Pestalozzi (1745–1827), Froebee (1782–1852), and Herbart (1776–1841).

It is interesting to look into the lives of famous Americans who excelled or were known for something special, but whose accomplishments in the field of handwork are outstanding, although probably little known to many of the general public. In this partial list we find president, poet, author, ambassador, clergyman, school teacher, barber, policeman, undertaker, and a famous scout, to mention a few.

Our first president, George Washington, is one of the few presidents after whom no piece of furniture has been named; yet we still have a cabinet he put together after his election to the presidency. He also is the inventor of a seeding plow, a wine coaster, and other farm devices.

Thomas Jefferson, our third president, invented the folding buggy top, the swivel chair, the modern plowshare, and a writing desk with an adjustable top, the original of which is still in the Smithsonian Institute at Washington.

The sixteenth president, Abraham Lincoln, was known to possess an appreciation of fine furniture and workmanship. During his youth he made a cabinet that had six small drawers and one full-length shelf and was described as follows: "Of walnut two feet in height and very well put together." Lincoln invented a device for raising steamboats that went aground on shoals in the Ohio and Mississippi Rivers.

A famous Bostonian, Benjamin Franklin, who according to his own epitaph would rather be known as printer, could have been classified as scientist, politician, postmaster, colonel (Pennsylvania Militia), ambassador, fire and police commissioner, publisher, college president. This is an outstanding example of a great man who was equally brilliant in the field of handwork. Franklin printed the first paper money used in New Jersey, he made the first bifocal eyeglass, the lightning rod, a mangle for pressing linen, and the Franklin stove. This stove was the first heater in which most of the heat did not go up the chimney. He is also credited with the invention of the first rocking chair.

A clergyman and poet, Edmund Cartwright invented the power loom and a New England school teacher, Eli Whitney, invented the cotton gin. Whitney is now known as the "father of mass production" because in 1798, he accepted a government order to manufacture rifles and through the use of machine tools that he made, produced parts that were interchangeable. Eli Whitney made nails during the Revolutionary War and then hatpins, and his cotton gin is really an application of a drum full of hatpins. He should be better known as the inventor of the "go and no

go" gauge used in modern production work.

Samuel Langhorne Clemens, better known as Mark Twain, was at one time apprenticed to a printer receiving as wages his lodging and his employer's castoff clothing. Mark Twain, creator of Tom Sawyer and Huckleberry Finn, invented the self-pasting scrapbook, and the adjustable and detachable strap for the backs of vests and trousers.

James Greenleaf Whittier, New England poet, made slippers to pay his way through an academy at Haverhill, Mass., and the Hoosier poet, James Whitcomb Riley, left school at 16 to work for a shoemaker. Robert Fulton originally made his living by painting, and when he went to England for further study he became interested in engineering and took out patents for many machines (dredging, spinning, ropemaking, sawing marble, etc.). Paul Revere, the Boston patriot, was a silver and goldsmith, and he practiced dentistry at 19 North Square, Boston.

Samuel F. B. Morse, inventor of the first telegraph instrument, was an accomplished artist. His portrait of Lafayette, which hangs in the mayor's office at City Hall, New York, is valued at $250,000. Morse's first telegraph instrument was made out of an old artist's canvas stretcher and portions of a wooden clock. Kit Carson, the famous Indian scout, was a very clever sketch artist.

Inventions are often caused by unusual situations as in the case of Almon B. Strowager, a Kansas City undertaker. Strowager invented the automatic telephone exchange because he thought a rival had telephone operators switching calls.

From this list we see that innately everyone has a talent for handwork if it can be encouraged or if he is put into a situation desperate enough to bring it to the surface.

INDIAN SILVERSMITHING

BEN HUNT

(*Continued from page 31 of the January, 1947, issue*)

Punches

Probably the most prized of all the Indian silversmith's possessions is his collection of punches which are used to stamp designs in silver. Their value lies in the fact that they are all handmade. They are not as a rule perfectly formed and regardless of how many similar punches there are of the same design, being handmade, there are no two exactly alike. Nor is the metal they are made of alike. A white man's collection of punches is usually uniform in many ways, because he can go to a dealer or hardware store and buy just the kind of steel he wants, in regard to size and shape. Not so with the Indian. He makes his stamps out of steel or iron that he picks up here and there. Old iron buggy tires are often used. They have acquired a toughness from pounding over gravel and stony roads. A lot of the metal he uses for dies is soft steel and iron and he tries to harden it by heating it red hot and quenching it in cold water. Some pieces of steel, such as old files, become very brittle and glass hard with that treatment, while others acquire little or no hardness. But the Indian somehow or other gets by with his simple tools, and produces jewelry that we, with all our modern and up-to-date equipment, can hardly hope to reproduce. It may be that we strive too much for perfection in small details, whereas the Indian looks at each piece as a whole. It seems that the imperfections in the jewelry produced by the Indian are so consistent that it really makes for more beautiful workmanship. This is true of nearly all Indian craftwork and is due to the fact that machine work does not enter into it in any way.

Some of the Indian's technique may be acquired by using tools and equipment similar to that which he uses. For your tools, therefore, use the material you have around the

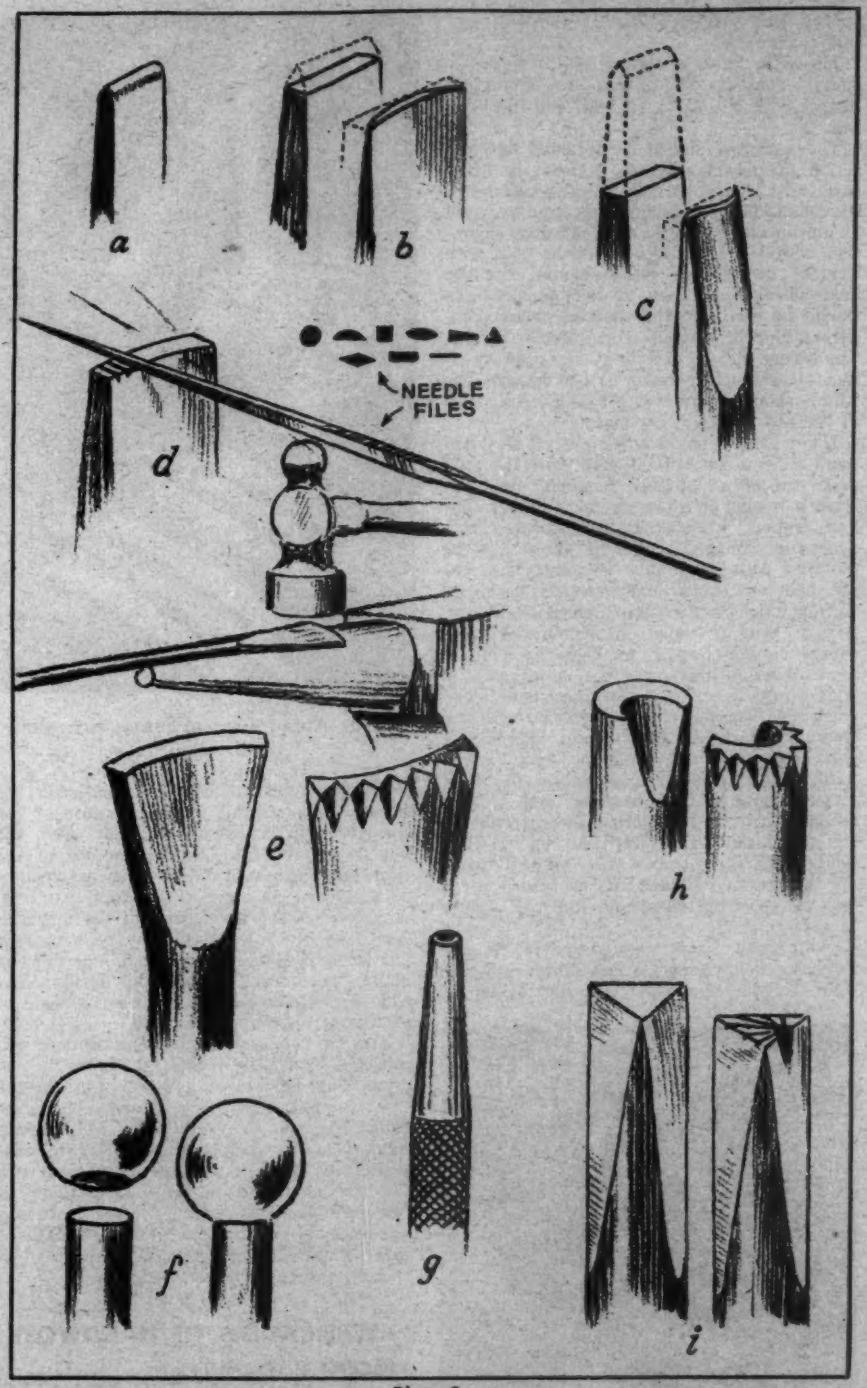


Plate 3

Handmade silversmithing tools

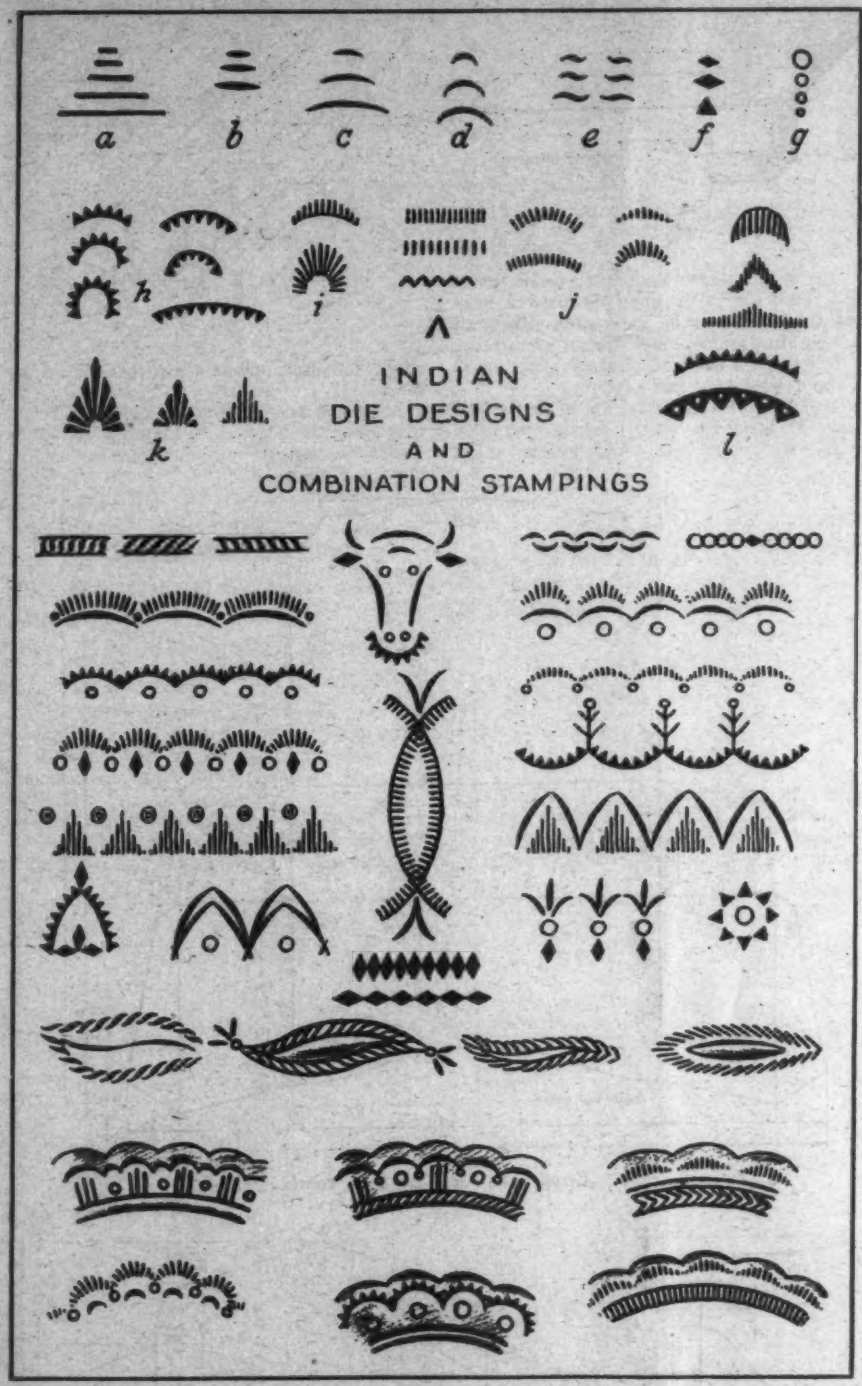


Plate 4

shop. Not scrap iron exactly, but pieces of steel that are no longer useful for something else. Of course, excellent punches may be made out of 3/16, 7/64, 5/16, and ⅜-in. diameter drill rod. Then too, ¼ to ⅜-in. cold chisels can be transformed into fine punches.

Plate 3 shows how to proceed in making punches out of cold chisels, some of which are of round stock and others of octagonal shape. Since they are already tempered they should be ground to shape on a power or hand grinding wheel, being careful not to burn them. You can make several straight punches by simply shaping the edge as shown in the enlarged sketch at *a* in Plate 4. This type of punch must be given a smooth, rounded, straight edge. Make 3 or 4 of this type, ranging from 1/16 in. in width to the width of your widest chisel. After they are ground, smooth them with fine emery or carborundum cloth and oil. Then make a few curved punches shaped like those shown at *c* in Plate 4. First grind off the edge as shown at *b* in Plate 3, and then grind them to shape and finish with fine abrasive cloth and oil.

Compound curves used in stamping rope and leaf designs (*e* in Plate 4 and *c* in Plate 3) can be made in the same manner from small chisels, without changing their temper or hardness. This work, done on a power grinder, calls for rather careful work but it saves a lot of time.

You can also make a couple of small diamond and triangular shapes (see *f*, Plate 4) in this manner, but that is about as far as you can go without annealing and retempering.

To produce the shapes shown at *h*, *i*, and *j*, in Plate 4, requires that the cold chisels be annealed first. Annealing means taking out the temper. This can be done by heating the cold chisel over a gas burner or blowtorch to a bright red, and then letting the steel cool very slowly. Probably the best way to do this is to bury the heated steel in hot ashes until it cools off. After that it can be shaped with files, and it is best to use needle files for this work. The general shape is filed first and then the fine lines and triangles, etc., as shown at *d* in Plate 3. Drill rod, when purchased, is very soft and easily filed. To make some of the larger dies requires a bit of forging previous to filing. That is where the ⅜-in. rod comes in handy. Heat it with a gas flame, furnace, forge, or blowtorch, and hammer it to about the shape you want. Then file it to shape and harden and temper it.

To harden and temper a punch, heat the design end and about one half of the punch to a bright red.

Then plunge the hot end into cold water. The design end of the punch is now hardened, while the other end is allowed to remain somewhat softer, and therefore tougher.

Next rub the design end of the punch with a piece of emery cloth until it is bright. Then reheat the front end of the punch by moving it about in the flame of the blowtorch. Do not put the design itself into the flame, and watch the part that has been brightened with the emery cloth. First you will see a straw color appear, then bronze, then a beautiful dark blue, and just as soon as this appears, plunge the whole punch into the water until it has cooled off fully.

Then finish the punch with abrasive cloth and oil, or a buffing wheel. Be careful not to take off any of the fine corners and edges of the hardened punch.

Trying to stamp hard silver will soon ruin a soft tempered punch. Anneal the silver you are working with and it will not ruin soft or medium hard punches nearly so fast.

At *f* in Plate 3 is shown how to make a dapping punch. Even though you have no dapping block you can hammer out half-rounded sections or parts of jewelry with such a punch, working on a hard piece of end-grain wood, such as the top of the log on which the anvil is fastened. To make these small dapping punches get an assortment of steel ball bearings measuring upwards of ⅜ in., to whatever diameter you wish to use. Then file or grind the end of a piece of steel rod to a flat section; and silver solder the ball to it. To do this soldering set the piece of steel rod upright and place the ball on the end of it. (See section on soldering which will come later.) Plunge the punch into cold water immediately after the solder sets. Indians often use the ball of a ball-peen hammer if that is the size contour they wish to hammer up. Getting back to the stamping punches, those shown in Figure 1 and Plate 3 may be used to produce a great many designs. Plate 4 shows a few of

the borders and complete designs that are made up of thunderbirds, arrows, arrowheads, horses, and other arrangements that are quite complicated. These designs are white men's designs. Stick to the simple dies that the Indian makes and uses, and your work will show up a lot better.

You may, from time to time, see other punch designs that are not shown here, but which you may want to make, but if you have those shown in Plate 4, you will have enough variety to last a long time.

An assortment of hollow nail sets of all sizes should also be in your collection. See Figure *g*, Plate 4. At *h* and *i*, Plate 3, is shown how punches are filed out of round drill or other steel rods. The symbolic cow's head with the cactus spines in her nose is rather unusual in Indian silver stamping, but it is amusing and does not require any special punches.

The lower two rows of designs in Plate 4 are edges stamped on concha buttons and pins.

CARD CASE

MARTIN PETERSON

Cincinnati, Ohio

This case holds recipe and memorandum cards, and also envelopes. It can be hung in a handy place on a cabinet door, side of a desk, or on a wall. The size of the case will vary according to the size of cards and envelopes that it will contain.

1. Draw a pattern, using drafting equipment. Include ¼ in. for laps to be soldered, or ½ in. for laps to be riveted.

Fig. 1. The finished job

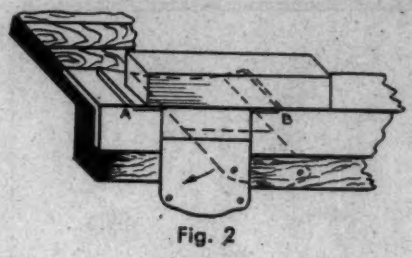
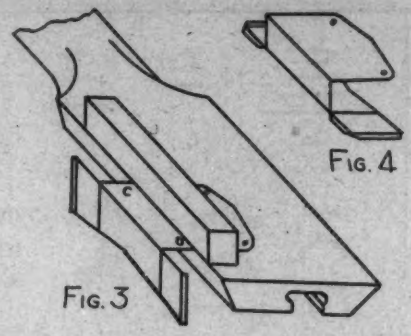


Fig. 2



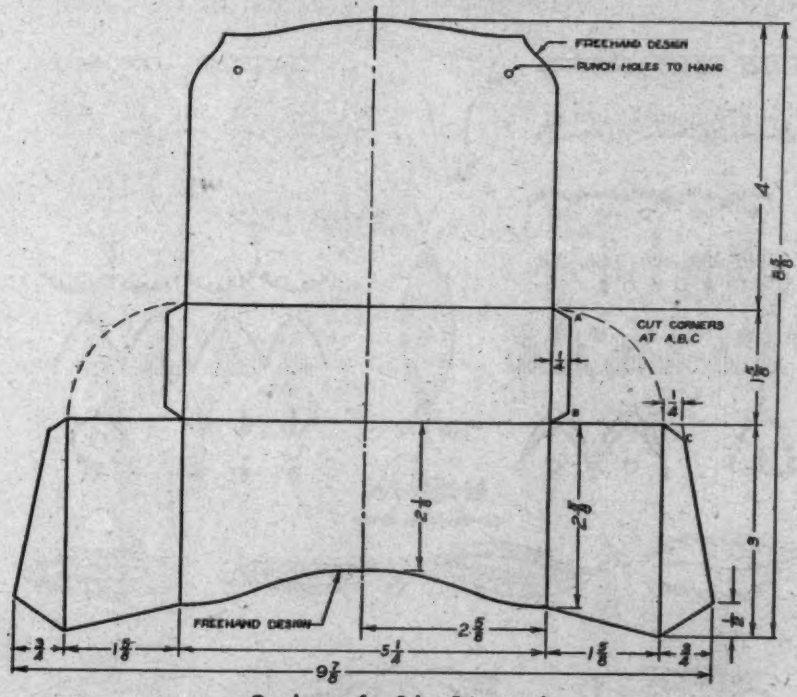
2. Cut the paper along the pattern lines.

3. Fold the paper along the pattern lines into the shape of the card case. Make all changes that are necessary for an exact fit.

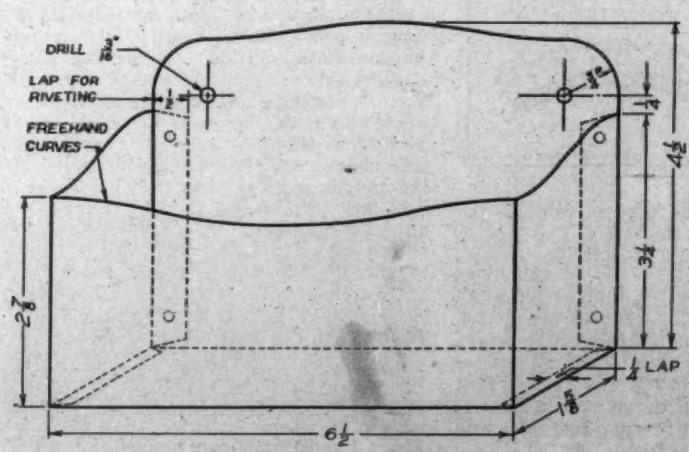
4. Obtain a piece of 28-gauge sheet metal of the desired kind and size.

5. Trace the pattern with a sharp lead pencil. Mark for the holes. Fold laps and draw along edge to be bent. Fold pattern at all edges and draw a line where bend must be made.

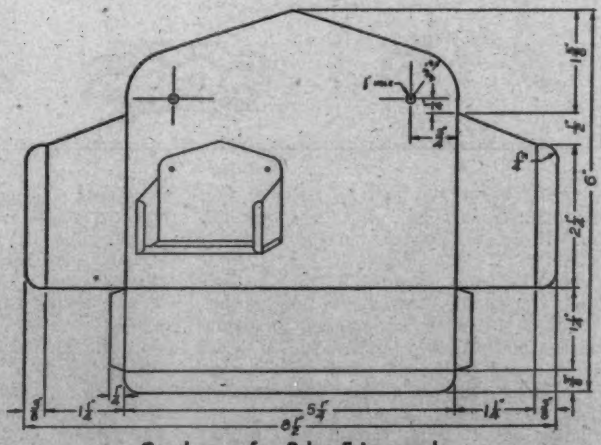
6. Bend edge A-B, by laying a heavy iron along the edge, as in Figure 2. Use your hand. Tap lightly with a mallet to make a



Card case for 3 by 5-in. cards



Card case for 4 by 6-in. cards



Card case for 3 by 5-in. cards

neat 90-deg. bend, as in Figure 2. Use the mallet sparingly.

7. Bend bottom at C-D on a stake (the hollow mandrel stake), as in Figure 3. The resulting shape is in Figure 4.

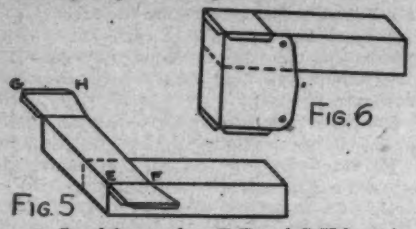


FIG. 5

FIG. 6

8. Bend front edges E-F and G-H by using an iron in a vise as shown in Figure 5.

9. Bend laps as in Figure 6.

10. Punch 3/19-in. holes to hang the card holder.

11. Solder the laps, or rivet the ½-in. laps.

12. Smooth and clean the finished card case.

13. Apply the final finish and decoration.

PLASTER BOOK ENDS

KENNETH R. KUEMMERLEIN

Appleton, Wis.

The book ends described and illustrated herewith are made of plaster-of-Paris cast in the mold shown in Figure 1.

The plaster is poured into the mold in three stages. The bottom step is poured first. After it has hardened somewhat, pour the second. Again, allow time for this one to harden a little, and then pour the third.

After the whole plaster has thoroughly dried out, remove it from the mold. Finish the book ends by smoothing up the surface, filling in any hollows that may have formed. After that they may be painted or bronzed as the taste of the craftsman may dictate.

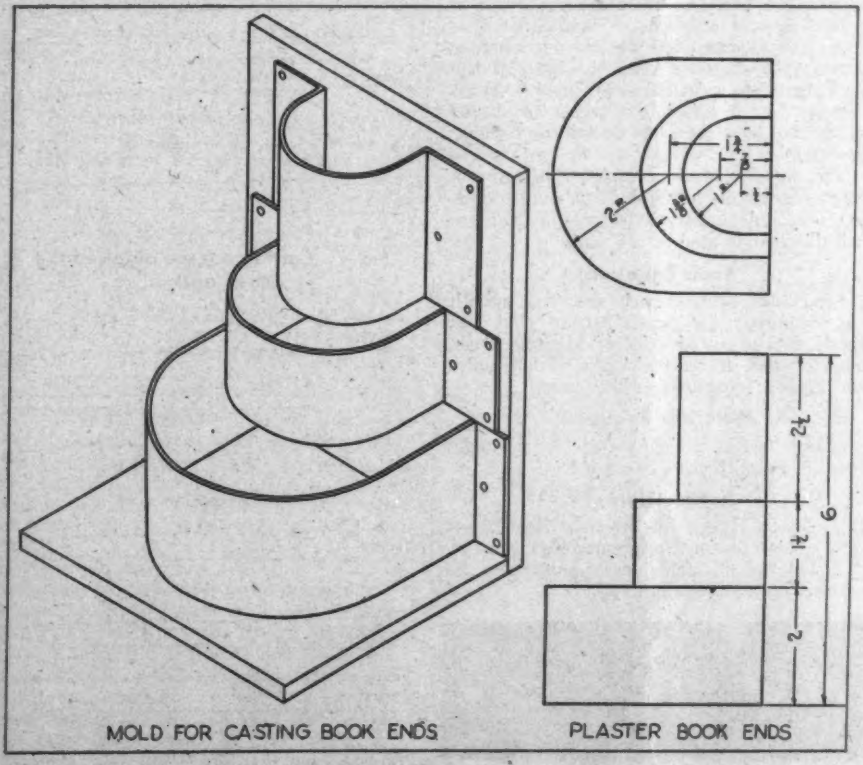


Fig. 1. Plaster book ends. Kenneth R. Kuemmerlein

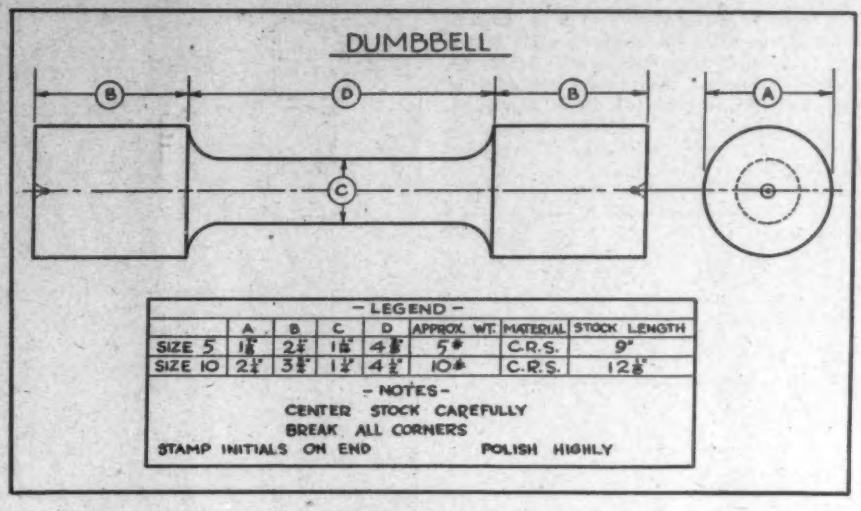
DUMBBELL

GEORGE F. LARTZ

High School

Frederick, Md.

The dumbbells described and illustrated herewith have been popular lathe exercises. By holding close to the dimensions, dumbbells of approximately 5 or 10 lb., will be obtained.



	A	B	C	D	APPROX. WT.	MATERIAL	STOCK LENGTH
SIZE 5	1⅛"	2½"	1⅛"	4⅜"	5#	C.R.S.	9"
SIZE 10	2¼"	3½"	1½"	4½"	10#	C.R.S.	12⅛"

Details of dumbbell

This project is an excellent beginner's job on the lathe, and the following general steps are used:

1. Get out stock.
2. Remove burrs and center stock carefully.
3. Turn between centers to diameter A.
4. Face ends and make reference points for the handle.
5. Turn handle to diameter C.
6. Finish ½-in. radius using radius gauge.
7. Polish highly.
8. Stamp initials on end and turn in for grading.

FOUR STAINLESS STEEL ART PROJECTS

AUGUSTINE J. BREZINA

Oswego, N. Y.

Stainless steel is obtained when the elements chromium, nickel, molybdenum, and others, are alloyed with steel. In this way a metal is produced which is strong, and highly resistant to nitric acid, boric acid, wine, fruit and vegetable juices, and many other staining agents. The most popular of the stainless steels is called 18–8, containing 18 per cent chromium and 8 per cent nickel. This particular steel, being ductile, corrosive resistant, and possessing metallic luster, is well adapted for cold forming methods. It is also readily available from surplus war stocks and may be found in various shapes and sizes on scrapped planes.

Stainless Steel Bracelet

Stainless steel lends itself readily to the construction of art metal projects, and a stainless steel bracelet may well be chosen as a beginning job.

A plain bracelet would be quite acceptable, but a more interesting and unique article may be made by using various decorative methods and designs. By so doing, the student will get additional practice in designing, layout, sawing, filing, decorating, polishing, and forming during the construction of the project.

An interesting, attractive, decorative design which will give the bracelet the appearance of a helix may be produced in the following manner. Lay out a series of diagonal lines across the face of the work as seen in Figure 1.

A piece of material 5½ to 6 in. long is ordinarily used for the clamp-on style bracelet. The width may be varied. After the bracelet blank has been sawed out, file the edges and ends to a smooth finish. The gauge of the material used is about 15, although lighter or heavier material may be employed successfully.

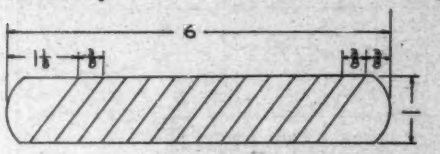


FIG.-1. LAYOUT

FIG.-2. SCORE LINES & ROUND EDGES

FIG.-3. CUT FILLETS ON EDGE

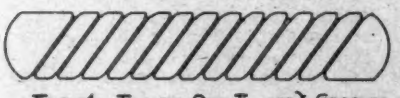


FIG.-4. FLARE OUT FILLETS & GROOVES

Scribe the diagonal lines carefully on the face of the blank. The width of the segments, angle of slant, the number of diagonals, and width of the bracelet, control the eventual appearance of the finished article. By varying these several factors, the individual has at his disposal many possibilities. Precision in layout is, of course, a requisite to insure symmetry of lines. After the diagonals have been scribed, score each one with a three cornered file as seen in Figure 2. For best appearance the width of the file mark should be slightly over 1/32 in. wide, but never more than 1/16 of an inch. It is best to file half the distance across the face from each side and then finally deepen the groove completely across. The difficulty of straying from the scored line during the filing process may be overcome by employing the thumb of the left hand as a guide against which the file can ride. File slowly and carefully in the initial process, as unnecessary scratches will require much tedious removal during the polishing process. Once the lines have been filed, very little difficulty will be encountered in subsequent operations. The depth of the groove, incidentally, should not exceed more than half the thickness of the metal, for too deep a crack may develop in the groove during the bending operation.

Now the ends of each diagonal groove are filleted and then flared out as seen in Figures 3 and 4. The segments are also trimmed, by being rounded slightly. These operations are easily accomplished with a round pattern file. Except for touching up a few deep scratches or tool marks, the filing may be considered finished.

In polishing, use progressively finer and finer grades of abrasive cloth, finishing with grit 400, and then buffing. In working with stainless steel, aluminum oxide type abrasives are preferred over the iron oxide variety. Iron oxide particles have a tendency to become embedded in the surface of the metal which

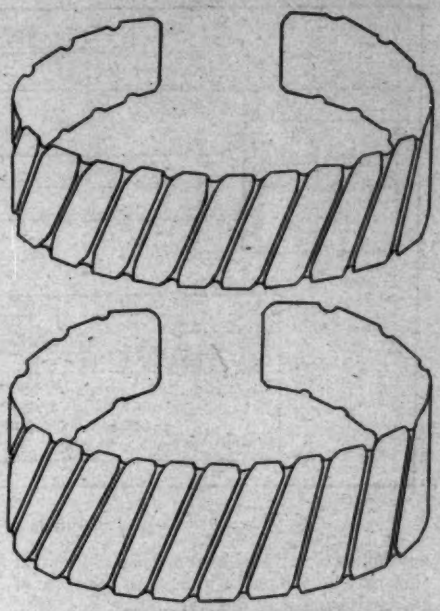


Fig. 5. The bracelets after shaping

may lead to discoloration. Likewise in buffing use only those compounds which are specifically intended for stainless steel materials, avoiding red rouge and rose tripoli since they both contain iron oxide. White rouge, however, will be found quite satisfactory for the work.

Prior to buffing, it would be wise to rinse the bracelets in warm soapy water to remove all particles of abrasive and other foreign matter. Following the buffing operation the bracelets may be bent to fit the hand. In shaping the bracelet, the polished surface is protected with a piece of cardboard. This protective medium will absorb the hammer blows while shaping. After the bracelet has been shaped to a desired size it may be given another light buffing job to regain any luster which may have been lost during the forming operation.

The bracelet is now complete, possessing a unique design and lasting brilliance impervious to stains, and comparable to some of the more valuable metals used in art work.

Tools Required

Steel rule, scriber, hack saw, flat smooth file, triangular file, small pattern oval and round files, assorted grits of abrasive cloth, mallet, wood or composition material, buffer and buffing compound (white rouge).

Materials Required

About .060-in. stainless steel 5½ to 6 in. long. The width may be varied.

Procedure

1. Select a piece of stainless steel about .050 to .060 in. thick or about 15 gauge.
2. Lay out a suitable design pattern on the blank with a scriber and rule.

Fig. 6. Stainless steel bracelets

3. Cut the blank out with a hack saw.
4. File all edges smooth and round the ends.
5. Score the diagonal lines with a three cornered file.
6. Cut fillets at each end of the grooves, use a small round pattern file for this job.
7. Flare out the fillets at each end of the grooves and then slightly round the segments.
8. Remove all tool marks with abrasive cloth, use grit 100.
9. Polish with subsequent finer and finer grades of abrasive cloth finishing with grit 400.
10. Wash with soap and water to remove all grit and metal particles prior to buffing.
11. Buff on buffing wheel to a high polish.
12. Form to wrist size over a piece of properly shaped wood or composition material. See Figures 5 and 6.
13. Protect the surface of the bracelet with a piece of leather or cardboard while shaping. Use a plastic mallet during the forming operation.
14. Test for shape and size while forming.
15. Bracelet may be buffed again after forming to regain any lost luster during the shaping process.

Stainless Steel Letter Openers

The unique decorative effect employed on the bracelets may likewise be applied to the construction of very attractive stainless steel letter openers. The spiral effect is applied to the handles of the letter opener as shown in Figure 8. Here, too, the width of the segments, angle of slant, number of diagonals, and width of the handle will control the eventual appearance of the finished article.

A piece of stainless steel .050 to .060 in., about 13/16 by 9⅛ will suffice for the project. Proceed by developing a suitable design

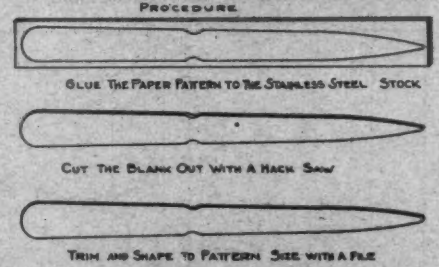

PROCEDURE
GLUE THE PAPER PATTERN TO THE STAINLESS STEEL STOCK
CUT THE BLANK OUT WITH A HACK SAW
TRIM AND SHAPE TO PATTERN SIZE WITH A FILE

Fig. 7. Cutting out the blank of the letter opener

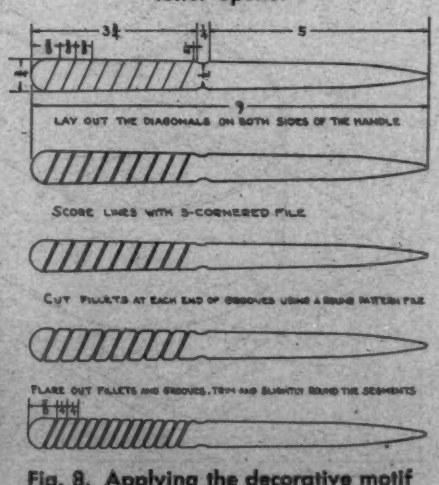

3¼
5
9
LAY OUT THE DIAGONALS ON BOTH SIDES OF THE HANDLE
SCORE LINES WITH 3-CORNERED FILE
CUT FILLETS AT EACH END OF GROOVES USING A ROUND PATTERN FILE
FLARE OUT FILLETS AND GROOVES. TRIM AND SLIGHTLY ROUND THE SEGMENTS

Fig. 8. Applying the decorative motif to the handle

pattern, which is then glued to the stainless steel stock. Next, cut out the blank with a hack saw. This done, trim and shape the blank to pattern size using a file. See Figure 7.

Having determined the type of handle desired, proceed to lay out the diagonals, bearing in mind that this design must slant in the same direction on both sides of the handle. Since the two sides are decorated, do not file too deeply from any one side. Apply the same procedure and technique as well as precautions used in making the bracelets.

After the handles have been completed, proceed to file the blank to the desired shape and edge sharpness. The tool operations completed, polish the letter opener all over with subsequent finer and finer grades of abrasive cloth, finishing with grit 400. Before buffing wash in warm soapy water to remove all traces of grit and dirt. In buffing it would be well to support the letter opener with a suitable piece of wood to avoid bending, or possible slippage while buffing. This last operation marks the completion of the project, which is not only attractive but useful as well.

Tools Required

Steel rule, scriber, hack saw, flat smooth file, triangular file, small pattern files round and ovai, assorted grits of abrasive cloth, buffer, buffing compound (white rouge).

Materials

Two pc. stainless steel .050 to .060 by 13/16 by 9⅛ in.

Procedure

1. Select a piece of stainless steel stock, .060 in. by 13/16 by 9⅛ in.
2. Develop a suitable design pattern for the handle and the blade of the letter opener.
3. Transfer to the blank, and cut out with a hack saw.
4. File in the design on each side of the handle.
5. Do not file too deeply as this may tend to weaken the handle.
6. Use the same procedures and techniques as used while making the bracelet.
7. File and shape the blend to desired shape and edge sharpness.
8. Remove all tool marks using grit 100 abrasive cloth.
9. Polish with abrasive cloths of assorted grits, finishing with grit 400.
10. Wash work with soap and water to remove grit and metal chips prior to buffing.
11. Buff to a high polish. Use a wooden paddle to support the work while buffing.

Stainless Steel Tie Clasp

The fundamentals and techniques employed in the development of the two preceding projects may likewise be applied to a number of other art metal jobs. The field is unlimited, and it is only the ingenuity of the individual that will limit his creativeness in designing things.

The project described here is a tie clasp which lends itself readily to be designed and executed in stainless steel, with very pleasing lines. Various sizes may be chosen depending on the taste of the individual. For those who like to delve in small precision work, there is the 5/16-in. clasp with very fine detailed filing to do. For those who like a more massive piece, there is the ½-in. clasp.

As mentioned previously the basic design still consists in filing grooves across the face

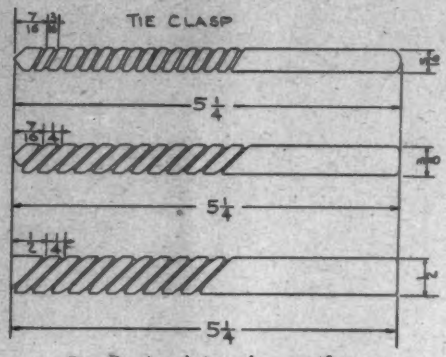


Fig. 9. Applying the motif to a tie clasp

of the work to effect a helixlike effect. In working with the tie clasps it will be necessary to use small pattern files to work in the design, since the jobs are small and the filing more detailed and more exact. A knife file and a round needle file are the predominant tools required for this work. Assorted grits of abrasive cloth will be required in the finishing and polishing process.

Select a blank of .060-in. stainless steel about 5/16 in. wide and about 5¼ in. long, and lay out a desired design pattern with a rule and scribe. The three tie clasp designs are only suggested as there are many possibilities which may be developed by the individual. A section of the center of the clasp may be left blank and used for engraving initials. The width of the file grooves is about 1/32 in. and about 1/32 in. deep. The grooves are spaced 3/16 in. apart. See Figure 9. The same procedures and precautions employed on the bracelets and letter openers should be exercised in the detailed tie clasp work.

Decorate about three inches of the blank, round the ends, and proceed to clean and then polish the work to a high luster. This done, determine the bend line which is about 2⅝ in. from the end. Place a protective medium on the work and then bend to a 90-deg. angle in a brake. Now place a 3/16-in. rod in the angle

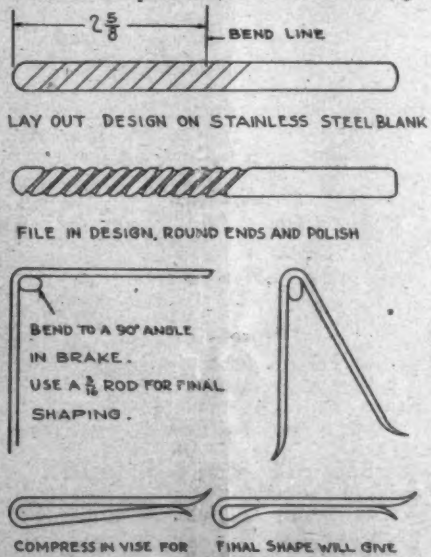

2⅝
BEND LINE
LAY OUT DESIGN ON STAINLESS STEEL BLANK
FILE IN DESIGN, ROUND ENDS AND POLISH
BEND TO A 90° ANGLE IN BRAKE. USE A 3/16 ROD FOR FINAL SHAPING.
COMPRESS IN VISE FOR FINAL SHAPE.
FINAL SHAPE WILL GIVE THE CLASP TENSION AND SPRING QUALITY.

Fig. 10. Shaping the clasp

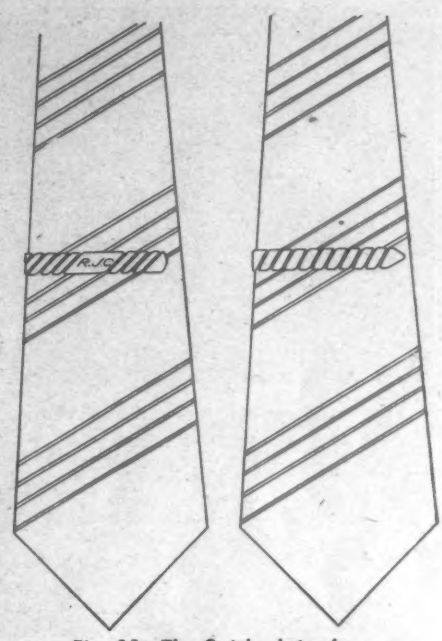


Fig. 11. The finished tie clasp

and using hand pressure, shape to a closed position, as shown in Figure 10. Then place in a vise and compress to a finished shape, which will also give the clasp the necessary spring tension.

The finished project may now be given a final polish on the buffing wheel and it is then completed.

Tools Required

Steel rule, scriber, hack saw, flat smooth file, set of small pattern files, assorted grits of abrasive cloth, folding brake buffer, and buffing compound (white rouge).

Materials Required

Stainless steel .060 in. About 5¼ in. long, and the widths may be varied to suit the individual.

Procedure

1. Secure required stainless steel blank.
2. Lay out the design with rule and scriber.
3. File in grooves, 1/32 in. wide and 1/32 in. deep. Use a pattern knife file and round needle nose file.
4. Fillet and flare out the grooves for a desired effect.
5. Round and smooth the ends with a file.
6. Remove all tool marks with abrasive cloth. Wash in hot soapy water before buffing.
7. Polish and buff.
8. Determine the bend line, about 2⅝ in., and bend.
9. Place in brake and bend to a 90-deg. angle. Be sure to use a protective medium such as leather while bending in the brake.
10. Insert a 3/16-in. rod in the angle and with hand pressure bring to a closed position. See Figure 10.
11. Place the clasp in vise and compress to a finished shape.
12. Give the tie clasp a final buff to regain any lost luster and the project is completed.

Stainless Steel Candleholder

The basic design used on the three previously described projects may also be applied to a candlestick as shown in Figure 12. Four

Fig. 12. Stainless steel candleholder

pieces of .060-in. stainless steel, ⅞ by 1¾ in., are required for the candle scrolls of a set of these candleholders, while two pieces of the same stock 5 in. in diameter are required for the bases. For details see Figure 13.

Lay out the design on the blanks with a scriber and then file in the diagonals. Remove all tool marks and bring the pieces to a high polish with finer and finer grades of abrasive cloth. Wash with soap and water to remove all grit and then buff to desired luster. Each end of the blank is then bent 90 degrees. This may be easily done in a folding brake. Protect the work while bending with a piece of leather. A ⅛-in. hole is then drilled in the center of each piece. Now proceed and bend the pieces to the scroll shape. Lay out a desired scroll shape on a piece of paper and then shape to the pattern. The bending may be done over a piece of round wood or composition material, using a mallet.

The base is formed by means of the simple jig, shown in Figure 14. This jig consists of two pieces of round steel 1⅛ in. thick and 4⅛ in. in diameter. The jig is provided with a locating pin to facilitate easy centering of the steel disks. Drill a ⅛-in. hole in each of the disks and then insert one of them in the jig. Secure the jig in a vise, or clamps may be used, and then proceed to set the edge of the blank down with a mallet. Work gradually around the outer diameter and do not try to form the edge in one operation or distortions may occur. If the work is done slowly and carefully it will be found that the stainless

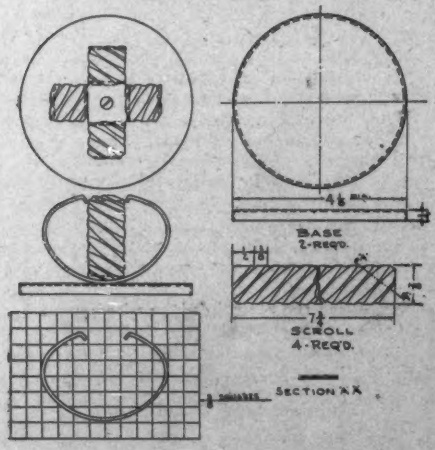


Fig. 13. Details of candleholders

steel will form quite readily to the 90-deg. angle. Take the base out, scribe a line ¼ in. from the top surface, and then cut the excess material off with snips and file the edge smooth. Repeat this same procedure on the second disk.

The next step is to polish the base to a brilliant luster. This may be accomplished by means of an auxiliary wooden faceplate. Fasten the disk to the faceplate with a fiber washer and a roundhead wood screw. Use low speed on the lathe for cleaning the base of tool marks and scratches. For polishing use fine grades of abrasive cloth and higher speeds. Finish polishing with grit 400, and a mirror-like luster should result. This luster will tend to reflect the candlelight and add to the general attractiveness of the project.

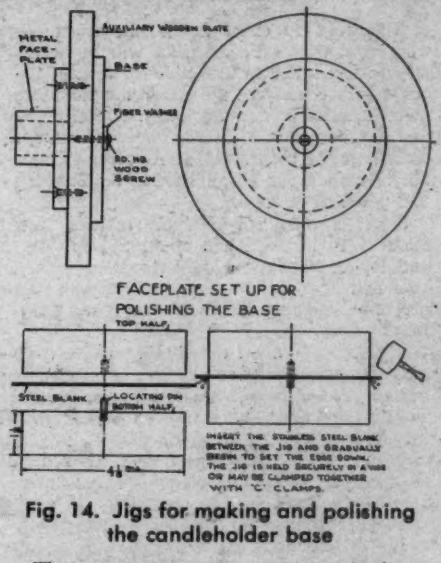

METAL FACE-PLATE
AUXILIARY WOODEN PLATE
BASE
FIBER WASHER
NO. 8 WOOD SCREW
FACEPLATE SET UP FOR POLISHING THE BASE
TOP HALF
STEEL BLANK
LOCATING PIN
BOTTOM HALF
INSERT THE STAINLESS STEEL BLANK BETWEEN THE JIG AND GRADUALLY BEGIN TO SET THE EDGE DOWN. THE JIG IS HELD SECURELY IN A VISE OR MAY BE CLAMPED TOGETHER WITH "C" CLAMPS.

Fig. 14. Jigs for making and polishing the candleholder base

The component parts are assembled together with No. 8–32 machine screws. The top of the screw may easily be hidden from view by making a small hollow in the bottom of the candle, which will tend to conceal the screw top. Adjust the scrolls for a springlike clamp on the candle and the project is complete.

Tools and Materials

Steel rule, scriber, hack saw, flat file smooth, triangular file, small pattern files, round and oval, abrasive cloth assorted grits, ⅛-in. drill, mallet, composition material, buffer and buffing compound (white rouge).

Materials

Four pc. ⅞ by 6¾ in. .060 stainless steel; 2 pc. 5-in. diameter .060 stainless steel.

Procedure

1. Secure necessary stainless steel for the scrolls and the base. Four pieces of ⅞ by 1¾ in., and 2 pieces 5 in. in diameter, stainless steel, .060 in. thick, are needed.
2. Lay out the desired design on the four blanks.
3. File in the diagonals as in previous procedures.
4. Remove all tool marks and scratches and polish to a smooth finish.
5. Wash with soap and water to remove all traces of grit.
6. Buff to high polish.
7. Bend ¼ in. of each end of the scrolls to a 90-deg. angle. Protect the work with leather while bending in the brake.
8. Drill a ⅛-in. hole in the center of each of the four blanks.
9. Shape the pieces to the desired scroll pattern. Bend around a piece of wood or composition material, using a mallet.
10. Cut out two disks 5 in. in diameter.
11. Fabricate the necessary jig for forming the edge or use a mechanical means if available.
12. Drill a ⅛-in. hole in the center of each disk.
13. Place the disk in the jig, and secure in a vise.
14. Begin to set the edge down with a mallet. Work slowly about the outer diameter until the edge has been formed. Then trim the edge down to a height of ¼ in.
15. Repeat on the second disk and then proceed to polish.
16. Set up an auxiliary wood faceplate on a lathe, fasten the base to the plate, and using slow speed, remove all tool marks.
17. Using grit 240, 320, and 400 together with high speed, polish to a high luster.
18. Assemble component parts with 8–32 machine screws. Carve a small hollow in the bottom of the candle to hide the top of the screw.
19. Adjust the scrolls for a springlike tension so that the candles can be held securely.

Personal News

DR. WARNER HONORED

Dr. William E. Warner, professor of education, The Ohio State University, Columbus, Ohio, recently received one of Belgium's highest decorations, the Order of Leopold II for services rendered to the Belgian nation while serving on Gen. Eisenhower's staff.

(Continued on page 20A)

Left to right: Baron Robert Silvercruys, Belgian Ambassador in the Embassy in Washington congratulating Colonel William E. Warner of the Ohio State University, Columbus, on his receipt of one of Belgium's highest decorations, The Order of Leopold II. The honor was granted by the Regent, Prince Charles, by Royal Decree.

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• Delta Abrasive Belt Finishing Machine
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Members and guests in attendance at the 33rd annual meeting of the Manual Arts Conference of the Mississippi Valley, Hotel Southmoor, Chicago, Ill., November 14, 15, and 16, 1946.

Front row (reading from left to right): Arthur B. Mays, University of Illinois, Urbana, Ill.; John J. Metz, INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Milwaukee, Wis.; William T. Bawden, State Teachers College, Pittsburg, Kans.; Verne C. Fryklund (chairman), The Stout Institute, Menomonie, Wis.; Homer J. Smith, University of Minnesota, Minneapolis, Minn.; John F. Friese, Pennsylvania State College, State College, Pa.; Clyde A. Bowman, The Stout Institute, Menomonie, Wis.; Albert P. Siepert, Bradley University, Peoria, Ill.

Second row: Kenneth L. Bing,* State College, Cape Girardeau, Mo.; Harry A. Pederson,* State Teachers College, Platteville, Wis.; Charles R. Klinison, Ohio University, Athens, Ohio; Ray M. Stombaugh, State Normal University, Normal, Ill.; Leon L. Gore, Peabody College, Nashville, Tenn.; Milo T. Oakland, State Teachers College, DeKalb, Ill.; Ernest J. Simon, State Department of Education, Springfield, Ill.; W. G. Wilson, The Haven School, Chicago, Ill.; Walter J. Klehm, State Teachers College, Charleston, Ill.; Louis V. Newkirk, Board of Education, Chicago, Ill.

Third row: Ammon Swope, Purdue University, Lafayette, Ind.; Frank E. Schroeder, State Teachers College, Richmond, Ky.; Wiley P. Klingensmith, Supervisor of Industrial Arts, Chicago, Ill.; Dewey F. Barich,* State University, Kent, Ohio; George J. Jennings, Supervisor of Industrial Arts, Chicago, Ill.; Victor Randel, State Teachers College, Huntsville, Texas; Wayne Wetzel, State Teachers College, Macomb, Ill.; C. Kenneth Beach, Cornell University, Ithaca, N. Y.; Thomas A. Hippaka, Iowa State College, Ames, Iowa; Sylvan A. Yager, State Teachers College, Terre Haute, Ind.

Fourth row: S. M. Dell, McPherson College, McPherson, Kans.; DeWitt T. Hunt, State A. & M. College, Stillwater,Okla.; G. Harold Silvius,* Wayne University, Detroit, Mich.; John L. Feirer, State Teachers College, Kalamazoo, Mich.; Otto C. Olsen, State Teachers College, Kearney, Nebr.; Ralph W. Whalen, State Teachers College, Richmond, Ky.; Edward C. Estabrooke, American School, Chicago, Ill.; Daniel J. Crowley, State University, Bowling Green, Ohio; and Fred J. Schmidt,* State Teachers College, Muncie, Ind.

*New members admitted Nov. 15, 1946.

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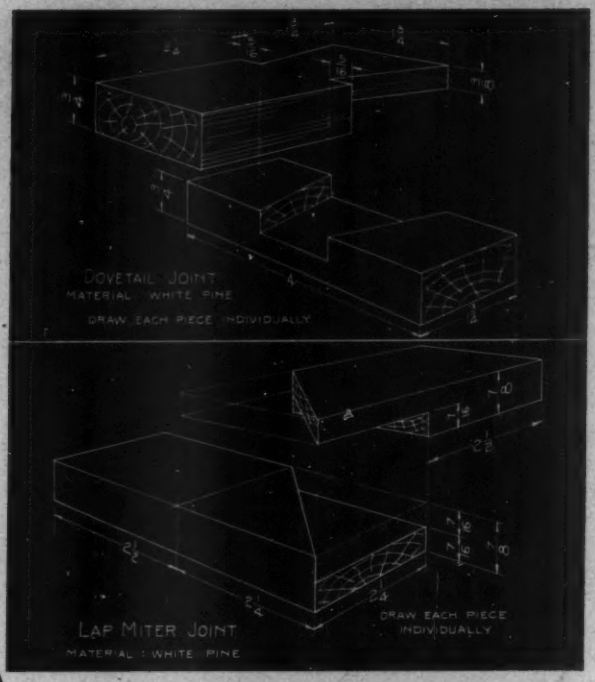

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(Continued from page 86)

The decoration was granted by the Regent, Prince Charles, by royal decree, and the official citation reads as follows:

"To Colonel William E. Warner, as Military Chief of Passive Defense for the Province of LIEGE, assumed, with greatest sang-froid and the most efficient comprehension, the heavy task of co-ordinating the American Military and Belgian Civilian Defense Services during the V-1 and V-2 saturation raids in 1944 and 1945, has always shown the example for courage and good nature, and by his continuous presence on the sites of incidents, has been a real leader."

Dr. Warner was in charge of the reactivation of all civil and fire defense services in the liberated countries of Europe. During the Bulge he organized and operated these services in the American zone of Eastern Belgium with headquarters at Liege. In doing this, he achieved the distinction of having the lowest casualty per bomb record in the European theater of operations where mechanical weapons were used.

The Belgian Red Cross also granted the highest decoration in its power to Dr. Warner.

PHILIP S. WALDECK APPOINTED STATE SUPERVISOR

Philip S. Waldeck has been appointed state supervisor of industrial arts for Ohio. Serving as Ohio's first supervisor of industrial arts, he has been assigned to the staff of elementary and secondary education in the State Department of Education.

Mr. Waldeck, a lieut. commander in the U. S. Navy, served three years as aviation engineering officer of a Combat Aircraft Service Unit. In the early months of World War II, he was assigned to the training school of the Naval Air Technical Training Command at Memphis, Tenn., where he assisted in the development of a curriculum for aviation machinist's mates and ordnance men. The close of the war found Mr. Waldeck stationed at Adak in the Aleutian Islands.

P. S. Waldeck

Mr. Waldeck, prior to the war, was instructor of general metals in the Columbus Public Schools, Columbus, Ohio. Active in industrial-arts programs in Ohio, he has served as chairman of state and sectional industrial-arts associations, and for several years, was a member of the state committee on industrial arts.

He holds the degree of bachelor of science and master of arts from the Ohio State University, with several hours toward his doctor's degree at the same university.

Mr. Waldeck is a member of the American Industrial Arts Association, Epsilon Pi Tau, Phi Delta Kappa, and Ohio Industrial Arts Association.

♦ AMOS G. WILLIAMS has been appointed assistant to Dr. Kenneth L. Bing, head of the industrial-arts department at Southeast Missouri State College, Cape Girardeau. Mr. Williams resigned his former position as instructor of architectural and machine drafting at Maine Twp. High School, Des Plaines and Park Ridge, Ill.

Mr. Williams received the M.S. degree at Iowa State College in 1936, served six years as instructor of industrial arts at Western Union College, Le Mars, Iowa, and was then appointed assistant professor of industrial arts at the Nebraska State Teachers College, Wayne, Neb.

Before joining the faculty of Maine Twp. High School he served as civilian instructor of military geography in the Army Air Forces Flight Training Command and subsequently was a civilian instructor of engineering drafting in the Navy V-5 and V-12 Training Programs.

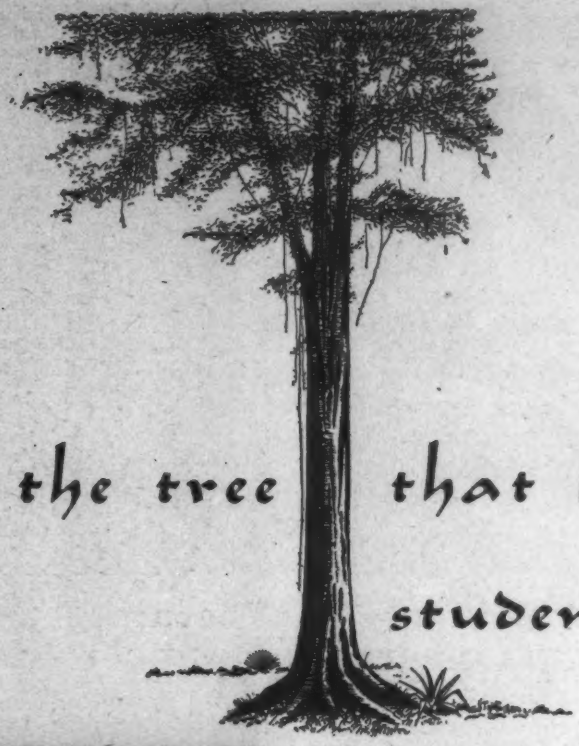
THEODORE A. SIEDLE JOINS ALUMINUM COMPANY TRAINING DIVISION

Theodore A. Siedle, dean of instruction at California, Pa., State Teachers College since 1938, resigned as of January 1, to accept a position with the Training Division of the Aluminum Company of America.

The program with which Dr. Siedle will be connected is designed to foster better understanding of the problems of labor and management. He will have charge of the preparation and development of materials for the Aluminum Company's Management Conference plan which is being established in each of its plants throughout the country. His headquarters will be in Pittsburgh.

Prior to going to the State Teachers College at California, Pa., Dr. Siedle was assistant dean of the School of Education, director of the Teacher Placement Bureau, and assistant professor of education at the University of Pittsburgh.

(Continued on page 22A)



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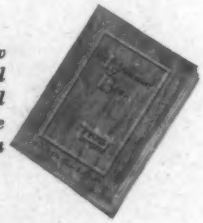

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(Continued from page 20A)

During the war, Dr. Siedle was on military leave from the Teachers College for four and a half years, returning on June 1, 1946. He served in the European Theater for 30 months as a staff officer with the Army Information and Education Division where he was responsible for the direction of the European branch of the U. S. Armed Forces Institute, and was relieved from active duty last summer with the rank of colonel.

DR. WHITCOMB DIES

Dr. Fred C. Whitcomb died of complications following a major operation, in the Fort Hamilton Hospital, Hamilton, Ohio, on Thursday, December 19, 1946.

Dr. Whitcomb was born at North Vernon, Ind., November 8, 1870. He was graduated from Franklin College, Franklin, Ind., and took advanced work at Teachers College, Columbia University. He received the honorary degree of doctor of law from Franklin College in 1936.

Dr. Whitcomb devoted his professional life to education. He served for a few years as industrial-arts teacher and as administrator in the secondary schools of Indiana. He accepted his first college position in 1904 as professor of practical arts at Howard University, Washington, D. C. He came to Miami University in 1906 where he served as professor of industrial arts education and director of the division of practical arts. At the time of his death he was professor emeritus of industrial-arts education.

Although Dr. Whitcomb retired officially in 1941 he continued to teach in the war emergency program until 1944.

He contributed to numerous professional magazines and is the author of a practical arts "Teacher's Manual" which was published in mimeograph form by Miami University. He was active in many professional and service organizations, was a life member in the Mississippi Manual Arts Conference, and laureate member of Epsilon Pi Tau.

♦ ROY W. SCHROEDER, foundry instructor, Washburne Trade School, Chicago, has been appointed to the educational division apprentice contest committee of the American Foundrymen's Association, technical society of the castings industry.

♦ The director of technical services of the U. S. Department of Commerce, Washington, D. C., has announced the appointment of five personnel experts to represent educational and government agencies in a study of German developments in personnel management and industrial training. The experts who have left for Germany to begin their study are DR. L. DEWEY ANDERSON, Washington, D. C.; DR. GILBERT BRIGHOUSE, Los Angeles, Calif.; DR. ALFRED B. KAHLER, New York City; TED F. SILVEY, Washington, D. C.; DR. MORRIS S. VITELES, University of Pennsylvania, Philadelphia; and DR. E. G. WILLIAMSON, of the University of Minnesota, Minneapolis. The investigators are traveling without expense to the government and they will present a report of their findings upon their return to the United States.

♦ JOHN M. LYNCH, after three and one-half years as an engineer aboard tankers and liberty ships in the U. S. Maritime service, has returned to teach industrial-arts work at Middletown High School, New York.

♦ ROBERT M. KECK has been appointed assistant to Dr. Robert M. Steel, president of State Teachers College, California, Pa.

Mr. Keck, previous to entering the army in 1942, had charge of the electrical department at the college.

♦ ARTHUR C. WENZEL is teaching sheet-metal pattern drafting and sheet-metal work, at State Teachers College, California, Pa.

♦ HAROLD B. TAYLOR has been given leave of absence from Purdue University to act as associate state supervisor of agricultural education for the state of Indiana.

♦ MILLARD BERRY, Ames, Iowa, is teaching machine-shop work in the high school at Champaign, Ill.

♦ AMOS G. WILLIAMS, of LeMars, Iowa, has taken a teaching position at the Southeast Missouri Teachers College in Cape Girardeau, Mo.

♦ LOYAL R. ROBERTS teaches metalwork in the junior-senior high school at LaJolla, Calif.

♦ CLARENCE HARTLINE has accepted a position as director of industrial education at Willoughby, Ohio.

♦ LEONARD C. SILVERN, who recently completed his service in the U. S. Navy, has accepted a position as training supervisor in the machine shop at the New York Naval Shipyard in New York City. A graduate of Long Island University, he is pursuing graduate work at Teachers College, Columbia University, and is supervising a 125 man job apprentice training program for the machinists.

♦ ROBERT FULTON, of Seymour, Iowa, is an instructor in the high school at Corydon.

♦ JOHN T. DAVIDSON, of Ames, Iowa, has accepted a teaching position at Seaside, Ore.

♦ MERLIN ERICKSON, of Ames, Iowa, teaches shopwork in the high school at Olin, Iowa.

♦ RAYMOND GLYNN and JOHN HOFFMAN, of Ames, Iowa, have accepted positions as industrial-arts instructors at Burlington, Iowa.

♦ ROBERT VAN TRIES has accepted a teaching position at Winnebago, Minn.

♦ CARL NIELSEN has accepted a position as instructor in industrial arts at Davenport, Iowa.

♦ RAYMOND PANNKUK teaches industrial arts in the schools of Tama, Iowa.

♦ LAWRENCE SIMMERING has accepted a position as supervisor of practice teaching in the high school at Ames, Iowa.

(Continued on next page)

♦ ALBERT M. OGENT has been appointed instructor of mechanical drafting at The David Ranken Jr. School of Mechanical Trades, St. Louis, Mo.

♦ WILLIAM KETCHEN, industrial-arts instructor at Emmetsburg, Iowa, has been elected chairman of The Great Lakes Industrial Instructors Group. This new organization was formed at the meeting of the North Central Iowa Industrial Education Association, held at Mason City, Iowa, in September.

♦ BILL DORMANDY has accepted a position as instructor of industrial-arts subjects in the junior high school, Scotia, N. Y.

♦ JOSEPH J. SAVOVITZ, of Ely, Minn., is teaching electricity and radio at the Polytechnic Institute at Billings, Mont.

♦ CECIL WREIDT has been appointed instructor of metalwork in the senior high school at Ames, Iowa.

♦ CLIFTON MATZ has accepted a teaching position in the high school at Davenport, Iowa.

♦ HOWARD A. REYMAN of Clinton, Iowa, has been appointed shop instructor at Nevada, Iowa.

♦ LYLE G. WINES has been appointed head of the department of aeronautics at the Utah State Agricultural College, Logan, Utah. The department operates a two-year aircraft and engine mechanics school under CAA approval No. 1175, as well as a four-year course leading to a B.S. degree in aeronautical engineering.

Mr. Wines is a graduate of The Stout Institute and holds a B.S. degree and M.S. degree from that school. Previous to his appointment at Utah State, he taught two years in Flint, Mich., and nine years in Dearborn, Mich.

During his stay in Dearborn he taught automotive mechanics and later was transferred into the department of aeronautics at Fordson High School. The last three years of his employment at Fordson also saw him operating the Pioneer Aero Service in copartnership with head of aeronautics in Dearborn. His aeronautical background in the teaching of and operating an aircraft maintenance shop prepare him well for his new position.

♦ ANGUS DOUPLE is teaching industrial-arts design and graphic-arts design, and ceramics at State Teachers College, California, Pa.

He holds a B.S., and a M.Ed. degree in art education.

♦ GEORGE J. BANDEMER has joined the faculty of The David Ranken Jr. School of Mechanical Trades, St. Louis, Mo., as teacher of mathematics.

♦ D. JANNAPOULO has accepted the position of instructor of science at The David Ranken Jr. School of Mechanical Trades, St. Louis, Mo.

♦ A. M. DREYSSE is teaching mathematics at The David Ranken Jr. School of Mechanical Trades, St. Louis, Mo.

♦ RICHARD B. STEWARD has been appointed instructor of mechanical drawing at The David Ranken Jr. School of Mechanical Trades, St. Louis, Mo.

♦ W. CARL WILSON, senior rehabilitation counselor in the Raleigh, N. C., district office of the division of vocational rehabilitation, has been promoted to head up the department of research and statistics in the state office.

♦ ELMO MOYER, electronics engineer, Educational Service Division, General Electric Company, and CLARENCE E. CROFOOT, head of the technical department of the Mont Pleasant High School, Troy, N. Y., taught a course in electronics at Oswego this summer. Twenty instructors and engineers registered in the course.

♦ ECKHART A. JACOBSEN has joined the State Teachers College, Fitchburg, Mass., as instructor in mechanical drawing.

His previous teaching experience includes teaching and supervision of industrial arts in Elmira, N. Y., 1940–46; and teaching of industrial arts at Hillsdale, N. Y., 1937–40.

Mr. Jacobsen took his undergraduate work at State Teachers College at Oswego, N. Y., and his graduate work at Cornell University.

♦ ALEX DUCAT, who spent the past year in England and Germany with the Army Technical Service, has returned and accepted a position as supervisor of the evening program in the Veterans School, Troy, N. Y. Mr. Ducat was formerly a supervisor of the war production training program with the State Education Department.

♦ "HAPPY" HOPKINS, formerly of Schuyler High School, is now an instructor in the Veterans School, Troy, N. Y.

♦ HAROLD WOODWARD, formerly of Scotia, is a member of veteran's staff, Troy, N. Y. Other additions to the veteran's staff are: NAT BROWN, SIL HURLEY, FRANK LAPENNA, TOM O'REILLY, JOHN SHERIDAN, BILL SCHREIBER, and TOM DEAN.

♦ DAVE "EDDIE" MEADE, formerly of the veteran's staff, Troy, N. Y., has been appointed director of extension and registrar at the Institute of Applied Arts and Sciences at Binghamton, N. Y.

♦ DAVID ALLEE is now director of industrial and technical education at the New York State Institute of Agriculture on Long Island, Farmingdale, N. Y.

♦ WILLIAM H. BLISS, B.S., from Central Missouri State Teachers College, and M.A., from Colorado School of Education, and graduate work at Washington University, with 14 years' teaching experience, will devote full time teaching drawing and industrial-arts shop courses at Northwestern State College, Natchitoches, La.

♦ CHARLES L. POZZINI will teach an evening course in model yacht building at Wayne University, Detroit, Mich.

♦ WILLIAM STIRTON taught a short, intensive, course on educational policies of industry, business, and labor in the community, at Wayne University, Detroit, Mich.

(Continued on next page)

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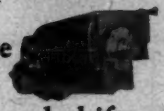
Safest because headstock, motor and drive  are fully enclosed; safest because all speed shifts are made with levers.

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(Continued from previous page)

♦ CHARLES L. NELSON, Los Angeles, Calif., retired at the end of school year 1945–46.

♦ EDWARD HUTTENGA, co-ordinator of trades and industrial education at Muskegon, Mich., has been made assistant to the director of vocational education of that city. He will be in charge of the Hackley Manual Training School and its annex.

♦ ESTELL H. CURRY of the Detroit, Mich., school system, taught at Wayne University in the industrial education department during the summer session.

♦ ARTHUR DUNHAM, who teaches a course in plastics on Wednesday evenings at the McMichael School, Detroit, Mich., taught this same course to a large group at the summer session held at Wayne University during the past summer.

♦ RUSSELL EMIG, who teaches woodworking, patternmaking, and cabinetmaking in the Detroit, Mich., school system during the regular school year, taught at Wayne University in the industrial education department during the summer session.

♦ HOWARD SECHREST taught a course in educational research at The Stout Institute, Menomonie, Wis., during the summer session.

♦ HARTLEY SCHAAL, after having returned from service, has been reassigned to the Hampton School, Detroit, Mich.

♦ R. O. WEATHERS, formerly co-ordinator at Hannibal, Mo., is now co-ordinator of training at the LeTourneau Technical Institute, Longview, Tex. Mr. Weathers received his master's degree in industrial education from the University at the close of the 1946 summer session. During the war years he worked with the Pratt & Whitney Aircraft Corporation, Kansas City, Mo.

♦ AL ALDINGER has joined the faculty at Vocational High School, Schenectady, N. Y., as teacher of industrial arts.

Association News

REPORT OF THE A.V.A. CONVENTION

The 40th annual convention of the American Vocational Association was held on December 4, 5, 6, and 7, 1946, at St. Louis, Mo.

The opening general session was held on Wednesday evening with C. L. Greiber, president, American Vocational Association, Inc., and state director of Vocational and Adult Education, Madison, Wis., presiding.

Captain William Exton, Jr., assistant to the Director of Naval Reserve, Navy Department, Washington, D. C., spoke on "The Naval Reserve and Vocational Training."

Unfortunately, Fernando Romero, director of technical information, Peru, was unable to attend.

R. W. Gregory, Assistant U. S. Commissioner for Vocational Education, U. S. Office of Education, Washington, D. C., presented the subject, "The Further Development of Vocational Education under the George-Barden Act."

Sessions of the Industrial-Arts Section

At the Wednesday afternoon industrial-arts session Homer J. Smith, professor of industrial education, University of Minnesota, Minneapolis, Minn., presided.

The subject for discussion was "Revision of the Bulletin Entitled 'Standards of Attainment in Industrial Arts Teaching.'"

Clyde A. Bowman, dean, The Stout Institute, Menomonie, Wis., discussed "History of This Publication Project"; while William T. Bawden, director of publications, State Teachers College, Pittsburg, Kans., reviewed the 1946 revision process.

Emanuel E. Ericson, Santa Barbara College, University of California, Santa Barbara, Calif., then presented "A Professor's Reaction to Content and Use"; and George F. Weber, director of vocational education, South Bend, Ind., spoke on the subject from the city supervisor's point of view.

Arthur B. Mays, professor of industrial education, University of Illinois, Urbana, Ill., gave a summary and lead in the discussion.

The Thursday afternoon session was devoted to the general theme, "Selection, Preparation and Use of Instructional Materials in Industrial Arts Teaching."

H. H. London, associate professor of industrial education, University of Missouri, Columbia, Mo., was the chairman of the panel discussion, the members of which were R. Wayne Adams, associate professor of industrial education, North Texas State Teachers College, Denton, Tex.; Walter A. Klehm, head, department of industrial arts, Eastern Illinois State Teachers College, Charleston, Ill.; Hugh L. Oakley, head, department of industrial arts, Eastern Kentucky State Teachers College, Murray, Ky.; Alfred H. Moore, head, department of industrial arts, Eastern Tennessee State Teachers College, Johnson City, Tenn.; R. H. Roberts, director of industrial arts and vocational education, Tulsa Public Schools, Tulsa, Okla.; and Robert E. Smith, professor of education, The Ohio State University, Columbus, Ohio.

The Friday afternoon session was presided over by George F. Henry, head, department of industrial arts education, Colorado A. & M. College, Fort Collins, Colo.

At this session Clifford K. Lush, director of industrial education, Minneapolis, Minn., spoke on how to recruit teachers of industrial arts.

Chris H. Groneman, acting head of department of industrial education, Texas A. & M. College, College Station, Tex., presented a program for training industrial-arts teachers; and Lowell L. Carver, assistant professor of industrial education, Iowa State College, Ames, Iowa, discussed methods of publicizing industrial arts.

(Continued on page 26A)

Emanuel E. Ericson
Chairman, Department of Industrial Education, University of California, Santa Barbara College

Verne C. Fryklund
President, The Stout Institute, Menomonie, Wisconsin

John F. Friese
Professor, Industrial Arts Education, Pennsylvania State College

Louis V. Newkirk
Director, Bureau of Industrial Arts Education, Department of Public Instruction, Chicago, Ill.

GENTLEMEN, IT'S HARD TO BEAT 4 ACES!

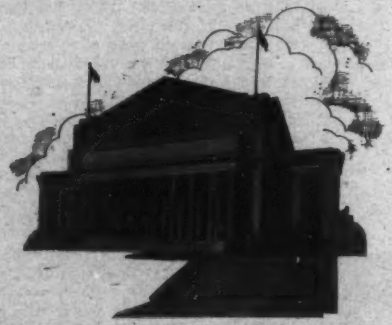
TEACHING THE INDUSTRIAL ARTS.
Ericson. *Completely revised, reset, 1946.* For the active or student teacher, this famous text has proved as practical as your paycheck itself! Traces a clearly marked path to success in all personal and professional relations of industrial arts teaching. Size, 5¾ x 8⅓ inches, a big, handsome book in every way; 388 pages, $4.00.

PRINCIPLES of TRADE and INDUSTRIAL TEACHING.
Selvidge and Fryklund. *Fryklund-revised, 1946.* Probably the most influential book in the entire literature of vocational and industrial-arts teaching theory. A complete, detailed exposition of the widely applied "Selvidge plan." Size, 5¼ x 7¾ inches, 395 pages, $3.00.

COURSE MAKING in INDUSTRIAL EDUCATION.
Friese. *New, 1946.* You will be hearing a lot about this "modern pioneer," so discover it for yourself today! At last, a textbook that deals solely with course planning in vocational and industrial arts education. *Includes five sample course formats.* Size, 6 x 9 inches, 297 pages, $3.00.

ORGANIZING and TEACHING THE GENERAL SHOP. **Newkirk.** *New, Spring, 1947. Based on an older text, THE GENERAL SHOP.* Warning: guard or padlock your copies of this one, or the numerous complete, wonderful examples of general shop projects are going to disappear! The first practical text on the subject. Large size, 7 x 9½ inches; 254 pages. (Probable) $4.50.

233 Duroc Building THE MANUAL ARTS PRESS Peoria 3, Illinois



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The Dean of the Graduate School, 234 Administration Building, will supply a Bulletin of General Announcement and a blank of "Application for Admission".

Bulletins of Summer Session may be obtained from the Director of the Summer Session, 802 Administration Bldg.

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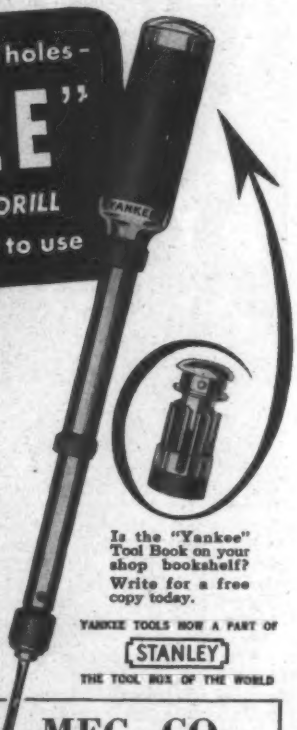

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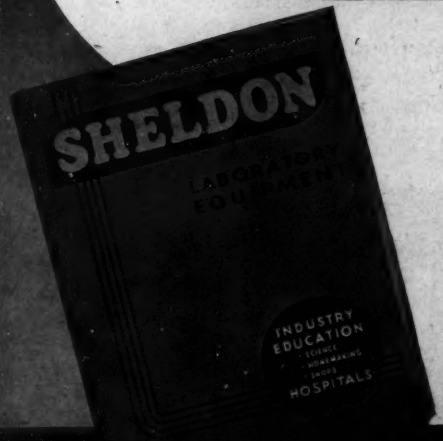

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(Continued from page 24A)

K. F. Perry, chairman, division of arts, Colorado State College of Education, Greeley, Colo., discussed methods of how industrial-arts instructors can keep themselves and their subject from becoming stale.

Emanuel E. Ericson, as chairman of the industrial-arts policies and planning committee of the A.V.A., gave his annual report.

At the Saturday morning session William R. Mason, supervisor of industrial arts, Cleveland, Ohio, presided.

The subjects presented were "Aluminum and Plastics Applied to Industrial Arts Education"; and Douglas B. Hobbs, educational department of Aluminum Company of America, who spoke on aluminum; and J. W. Richardson, district manager, St. Louis Division, Rohm and Haas Company; and G. Weller, technical representative, design and model shop, Philadelphia Division, Rohm and Haas Company, presented the case for plastics with special emphasis on plexiglas.

Both presentation and the articles exhibited were extremely good, and great interest was aroused.

Gordon O. Wilber, director, division of industrial arts, State Teachers College, Oswego, N. Y., led a spirited discussion.

The Banquet

The annual banquet was held at 6:30 p.m. on Thursday, December 5,

President C. L. Greiber presided.

Milford M. Hamlin, American Type Founders Sales Corporation, sang the Lord's Prayer in his usual excellent style.

After L. H. Dennis, executive secretary, American Vocational Association, Washington, D. C., had presented the guests at the speakers' table, President Greiber introduced Ralph S. Foss, New York City, who then took over as toastmaster and introduced the main speaker, Honorable Graham A. Barden, member of Congress from North Carolina, and coauthor of George-Barden Vocational Education Act.

Sessions of the Industrial Education Section

S. Lewis Land, president, National Association of Industrial Teacher Trainers, and director of Vocational Teacher Education, The Pennsylvania State College, State College, Pa., presided at the Wednesday morning session.

S. Grant Conner, Industrial Teacher Training, State Education Department, New York City, gave an address on "Content of Professional Courses in Curricula for Vocational Industrial Teachers."

Discussions on "In-Service and Alertness Courses for Vocational Industrial Teachers," "Evaluative Criteria for Vocational Industrial Schools and Classes," and "Development of Instructional Materials for Related Subjects Classes for Apprentices," followed.

Wednesday afternoon two sessions were held —one on apprentice education under the chairmanship of Philip L. McNamee, assistant superintendent of schools in charge of Vocational Education, Chicago Public Schools; and one on industrial education programs for veterans, under the chairmanship of R. W. Kent, director, Essex County Vocational Schools, Newark, N. J., and member of Special Advisory Committee of Veterans' Administration on Vocational Rehabilitation, Education, and Training Problems.

(To be continued)

♦ At the November 8 meeting of the board of directors of the Iowa Industrial Education Association, Abner L. Anderson, member of the original firm of Heston and Anderson, Fairfield, Iowa, was unanimously elected an honorary life member in the Iowa Industrial Education Association. His active interest in industrial arts in Iowa over a long period has made him widely known and respected. Honor keys for teachers who have taught industrial arts for 25 years or more have been provided as a courtesy of the Heston and Anderson firm. Holders of these keys become members of the "Twenty-five Year Club" of the Iowa Industrial Education Association.

The origin of the firm of Heston and Anderson is both interesting and fascinating. In 1915 Mr. Heston and Mr. Anderson were operating a home workshop and needed a bench band saw but there were none on the market. They designed and built one, which was so successful that orders were placed for them at once.

Heston and Anderson without any thought of building a business created something that was really wanted by the woodworking industry and ever since they have been furiously busy trying to keep up with industry's demands.

In 1925 the first factory was built. Soon a full line of woodworking machinery was added, including table saws, jointer, shaper, and wood lathe. The high quality and reasonable cost of the products made them popular everywhere.

In 1943 Mr. Heston died and the business was sold. While no longer a member of the firm, Mr. Anderson continues with the new organization. The company name still is Heston and Anderson.

♦ The Texas State Teachers Convention was held at Houston, Tex., on November 29, 1946.

At the Friday afternoon industrial education meeting, Chris H. Groneman, A. & M. College of Texas, College Station, Tex., presided.

W. E. Lowry, executive director, Texas State Board for Vocational Education, Austin, Tex., spoke on "New Vocational Legislation."

D. A. Childre, district supervisor, Business Men's Assurance Company, Dallas, Tex., discussed the subject "Texas Vocational Association Group Insurance Program."

(Continued on next page)

The next speaker, Victor Randel, head, industrial-arts department, Sam Houston State Teachers College, Huntsville, Tex., presented "The Future of Industrial Education as Viewed Nationally."

C. C. Davis, industrial education department, North Texas State College, Denton, Tex., spoke on "Development of Industrial Arts Departments With Government Surplus Equipment."

Glenn Fletcher, supervisor of industrial arts and vocational education in Houston Public Schools, acted as toastmaster at the Annual Texas Vocational Association Breakfast on November 30, 1946, at 7:30 a.m.

A panel of legislators from the Houston area discussed legislation pertaining to vocational education.

♦ The semiannual meeting of the state council of education of the California Teachers Association was held in Los Angeles on December 13 and 14.

Questions considered at this meeting included the state-wide plan for teachers' recruitment, juvenile delinquency, and legislation affecting education.

♦ Two teachers' symposiums were held Saturday, December 7, at the San Diego and Imperial County Administrators Association Conference at San Diego State College, San Diego, Calif.

Dr. Walter R. Hepner, president of the San Diego State College, was the chairman at the morning session.

The question discussed was "Who Will Teach Tomorrow?" and the members on the symposium were Dr. Jay D. Conner, assistant superintendent of city schools; Dr. Clarence Fielstra, director of curriculum for county schools; Henry Molino, principal of Central School; and Dr. Richard Madden, State College Director of Elementary Education.

Dr. Donald Watson, dean of general education of State College, and president of Omega Field Chapter, presided at the luncheon.

The afternoon symposium consisted of Dr. John S. Carroll, superintendent of county schools, and the subject discussed was "Where Do We Go From Here?"

♦ The American Standards Association, at its two-day meeting held in New York, elected new officers for the year 1947. Frederick R. Lack was elected president, and George H. Taber, Jr., was named vice-president. Mr. Lack is director of the Institute for Radio Engineers, and Mr. Taber is executive vice-president of the Sinclair Refining Company.

♦ Psi Chapter of the Epsilon Pi Tau Fraternity held a social meeting at State Teachers College, California, Pa., on November 12, 1946. Prof. Angus Douple gave a demonstrative lecture on "Color and Design of Children's Toys."

♦ The Associated Guilds of Teachers of Shop Work of New York City is composed of five member guilds: Richmond Guild, Bronx Guild, Brooklyn Guild, Manhattan Guild, and Queen's Guild.

The officers of the executive council for 1946–47 are: president, John M. Hurley, 301 Battery Ave., Brooklyn 9, N. Y.; vice-president, Fred P. Berrian, 219 Potter Ave., Staten Island 2, N. Y.; recording secretary, Charles E. Denely, 52–10 241 St., Douglaston, L.I., N. Y.; corresponding secretary, Walter Lockwood, 241 Mosholu Parkway North, Bronx 67, N. Y.; treasurer, Charles Passiglia, 22 Jagoe St., Bergenfield, N. J.

♦ Mu Sigma Pi Fraternity held its 15th annual initiation and banquet on November 15, 1946, at Detroit, Mich.

(See picture of Manual Arts Conference on page 18A)

More persons were killed in rural traffic accidents in 1945 than were killed in traffic accidents in cities and towns. The number of rural accident victims was 17,100 and traffic fatalities in cities and towns numbered 11,400.

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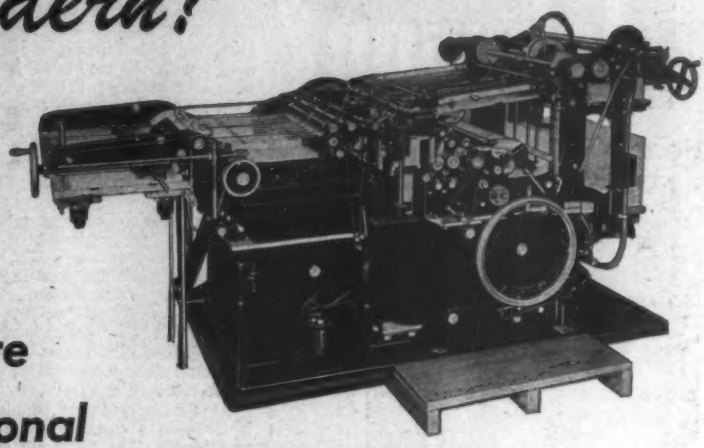

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News Notes

♦ A new index, "Motion Pictures and Slide Films for School Use," is announced by the school service department of the Westinghouse Electric Corporation.

Available free except for transportation costs, the films described in the catalog cover a wide range of subjects for high school classes. Several of the films listed are new ones, available to schools for the first time. The booklet contains recommendations as to the type of class for which each film is best suited and suggestions for related supplementary materials to enhance each film's usefulness in the classroom. For convenience in requesting film bookings and related materials order blanks are included in the catalog.

Teachers may secure a copy of the new index through the School Service Department, Westinghouse Electric Corporation, 306 Fourth Avenue, Box 1017, Pittsburgh 30, Pa.

♦ The U. S. Department of Labor, Washington 25, D. C., has issued a reprint of an article on an approved apprentice program carried on for several years in Atlanta, Ga. The program, which was established in 1942, is being conducted under the direction of H. P. Gormley and B. J. Seckinger, Jr., of Atlanta. The term of apprenticeship in each trade is five years, and each apprentice is required to attend classes at least four hours a week. Apprentices who have had previous practical experience in either the plumbing or

(Continued on next page)

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(Continued from previous page)

steam-fitting trades receive credit for that experience, which entitles them to advanced status at the start of the training.

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The work processes in which steam-fitter apprentices are trained are: (1) installation of piping for power heating and related purposes; (2) installation of piping for mechanical refrigeration and pneumatic tube systems; (3) the assembly in position and connection of equipment and appliances used in steam-fitting, power pipe fitting, refrigeration, oil burners, stokers, air conditioning; (4) welding connected with the trade; (5) maintenance and repair of heating, refrigeration, oil burners, stokers, air conditioning, etc.; (6) operation, care, and use of tools connected with the trade.

At the end of the training, each apprentice is awarded a certification of completion of apprenticeship. The certificate corresponds with the diploma awarded graduates of schools and universities, and is the official recognition of the apprentice's new status as journeyman.

♦ With a new million-dollar Institute of Industrial Research leading the way, expansion in Syracuse University's program of studying and providing trained personnel in business management is under way.

Specialists in chemical engineering, business law, accounting, transportation, economics, industrial engineering, personnel relations, and marketing joined the University's faculty recently to implement its services.

The Institute's objective will be to conduct exhaustive inquiries in numerous fields to assist industrial and business interests, mainly in central and northern New York. The Institute is expected to become one of the foremost centers of research in the country. University faculty will direct work in research and will be assisted in policy making by leaders of industry.

Dr. Ralph E. Montonna, assistant dean of the Graduate School, University of Minnesota, took over his duties December 1 as director of the Institute.

♦ Part-Time Co-operative Departments in Diversified Occupations are being instituted for the first time in Webb City and Independence, Mo., this year. Richmond and Trenton, Mo., are re-establishing this department in September. In addition, this work is being added to the high school curriculums of four schools in Kansas City and one in St. Joseph, Mo.

Mexico, Popular Bluff, and Warrensburg, Mo., are adding day trade school departments to their high school programs.

♦ It has been announced that Wayne University, Detroit, Mich., is now offering a new program leading to the doctor of education degree.

♦ The Advertising Federation of America, 330 West 42nd St., New York 18, N. Y., has announced a high school essay contest on advertising on the subject, "What Advertising Can Mean to the Future of America." Prizes will be awarded by each club to the winners in the local contest. In addition, certificates of award will be presented to first, second, and third prize winners by the club, in co-operation with the national organization. The contest is limited to students in senior high schools, including public, parochial, and preparatory schools. Winning essays must be in the hands of the judges by April 15. The chairman of the national essay contest committee is Paul C. Smith, Peoria, Ill.

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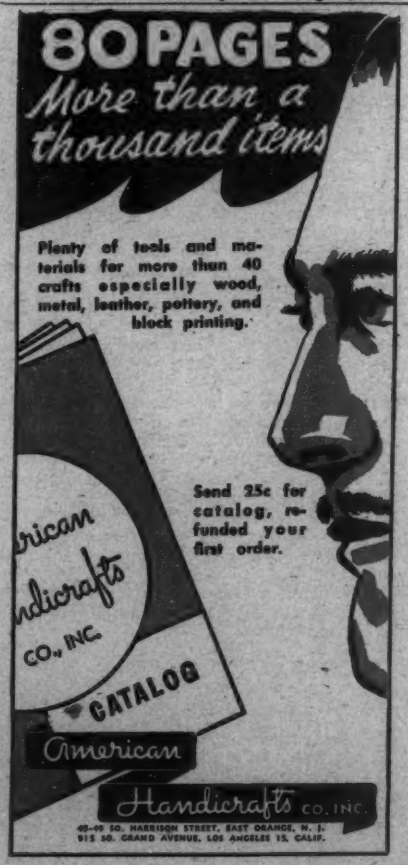
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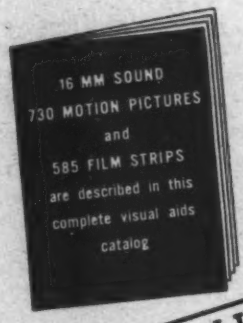

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Dallas 1—109 N. Akard St. ■ Los Angeles 14—1709 W. Eighth St.

New Publications

Freehand Sketching for Engineers

By William Wfrt Turner. Paper, 45 plates, 8½ by 11 in., illus., $2.50. The Ronald Press Co., New York, N. Y.

This set of freehand sketching plates contains a very instructive section on freehand sketching procedure. This is followed by plates giving instructions on and experience in making orthographic projections, auxiliary views, sections, and pictorial representation. A minimum of lettering exercises are given, and pencil work only is expected of the student.

How to Use Handicapped Workers

By Arthur T. Jacobs. Cloth, 186 pp., 5½ by 8¼ in., $3.50. National Foremen's Institute, Inc., Deep River, Conn.

The object of this book is to help employers to fit the job to the individual rather than vice versa. This is of special importance when handicapped persons are employed.

The author shows how a physical demand analysis can be made, how the worker's physical capacities can be analyzed, and how proper placement can be affected.

The book also shows how physical demand forms are made out, and several of those forms, fully made out for certain jobs, are shown.

An alphabetical list of diseases and handicaps also is shown.

Practical Electrical Mathematics

By William Edward Rasch. Cloth, 360 pp., 5⅛ by 7⅛ in., illus. $2. D. C. Heath & Co., Boston, Mass.

This is a mathematics specially written for the student in electricity. It also will be found helpful by the mechanic who wants a refresher course in the mathematics of electricity.

The appendix contains the electrical symbols, a very helpful table of useful circle formulas, a soft copper wire resistance table, and also a table showing the safe carrying capacities of copper wire, wire sizes for motors, and power and reactive factors.

The Rubber Industry

By Josephine Perry. Cloth, 127 pp., 6¼ by 8¼ in., illus. $2. Longmans, Green and Co., Inc., New York City.

This is a short account of what America has accomplished in this important industry in the utilization, processing, and manufacturing of needed articles out of natural and synthetic rubber.

The book presents the subject in 12 chapters which contain a brief history of the rubber industry, the source of crude rubber, how the latex is gathered and prepared for the market, the American plantations, synthetic rubber, and the manufacture of footwear, tires, and other products.

The engineering research entered into by the industry also is described.

Machining Aluminum Alloys

Produced by Technical Editorial Service, Reynolds Metals Company, Inc., Louisville 1, Ky. Spiral paper binding, 124 pp., 5⅞ by 8¼ in., illus., $1.

A well-illustrated book on the machining of aluminum alloys in which are discussed the speeds and feeds at which machining operations are to be carried out; general tool design information for various types of alloys; and information on turning, milling, shaping and planing, drilling, reaming, tapping and threading, filing, sawing, and grinding.

The book also contains a number of useful tables based on aluminum and its alloys.

Jobs Ahead

By Reginald M. Cleveland and Frank B. Latham. Cloth, 259 pp., 5⅜ by 7⅞ in. $2.50. D. Appleton-Century Co., Inc., New York and London.

A book for those who want to find out where science fits into the world of work. A perusal of the table of contents shows the wide field which the authors covered.

The 11 chapters into which the book is divided treat the material as follows: Jobs in the World of Tomorrow; The Challenge of Science; More and Better Health Care; Atoms and Electrons on the March; Engineers — Masters of Machines and Ideas; Automotive Opportunities; Building the Future; Conservation Has a War to Win; Transportation Looks Ahead; Distribution — Bridge to Prosperity. The last chapter is titled "On Your Own" and describes the place of the small business in America.

Vocational Education in the Years Ahead

Bulletin No. 234, General Series No. 7, Vocational Division.

Obtainable from the Superintendent of Documents, Washington 25, D. C. Price, 50 cents.

A report of the committee to study postwar problems in vocational education in the fields of agriculture, business, homemaking, industry, and guidance.

Creative Old Age

By Clare de Gruchy. Cloth, 143 pp., 5½ by 7⅝ in., illus., $2.75. Old Age Counselling Center, San Francisco, Calif.

An attempt to help the aged live lives of usefulness and happiness. The book describes the work of the Old Age Counselling Center at San Francisco, and presents a number of case histories and group projects.

JOB-TESTED!

FOR 94 YEARS

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This "Greyhound" hand saw is a direct descendant of the pioneer "George H. Bishop" line started almost a century ago. Improvements have been made constantly with new designs to meet the requirements of carpenters on the job. New, better steels, made to our own specifications, now give improved cutting edge and longer sharpness life. They've been job-tested through the years to bring you a better hand saw for fine carpenter work.

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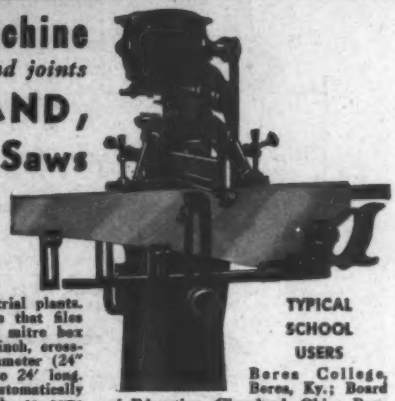
automatically files and joints
HAND, BAND, CIRCULAR Saws



The Foley Saw Filer is ideal for sharpening saws used by students in school shops. It keeps them in tip-top shape, faster and better than by hand filing. Used by Army, Navy, hundreds of manual training departments and industrial plants. The Foley is the only machine that files and joints all hand, back and mitre box saws from 3 to 16 points per inch, cross-cut circular saws up to 16" diameter (24" optional), and band saws up to 24' long. Patented jointing principle automatically evens up large and small teeth, so saws cut faster, truer, cleaner — stay sharp longer. Foley filed saws have less breakage and last longer.

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Please send full information on Foley Saw Filer and details 30-Day Trial Offer.

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"When we started our **Jet Propulsion Course,**" said the training director of one of our largest industrial concerns, "we had trouble locating a text until we found the one published by American Tech." Thoroughly convinced that A.T.S. had not entered the field of reaction-type aircraft, I cautiously inquired the name of the book, and found, to my surprise, that it was our book—*Winston's* THERMODYNAMICS. "Of course Winston didn't write the book for such a course," the training director said, "but the principles were there, the book was practical, and it gave us something around which we could build our course."

Encouraged—and don't think his statement didn't stimulate me to ask questions—I probed further. He said, "We have experts available who have the information *in their heads* for almost any new course, but we have a rule that a course is never started until we have an appropriate text in our trainees' hands."

Yes, a good text does give you a foundation for your course, without restricting the latitude of the course, or hindering the individual initiative of the instructor. It gives you insurance against carelessly prepared lessons. It teaches trainees the function of an important tool that they can use for continuing their education long after they have left your training program. It is a teacher's silent partner.

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Please send the books circled below for 30 days examination. If any of the books are adopted and 12 or more copies ordered, I will retain the adopted books as desk copies; otherwise I will return them or remit less the educational discount.

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YOUR FAVORITE stopper is here. Your dealer may have Higgins waterproof black in stock with both popular stoppers or he can get them on demand. Schools prefer quill type, claiming less accidents. Artists prefer the dropper stopper as they can place a puddle of liquid black in a well slab with greater ease. Draftsmen who use ruling pens only prefer the quill type, but those who use Wrico or LeRoy lettering instruments find the dropper indispensable. As is befitting the world's leading drawing ink manufacturer, "Higgins" brings both to your convenience.
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Shop Equipment News

NEW PRODUCTS — PUBLICATIONS

NEW HEAVY DUTY GRINDER

A new 6-in. heavy duty bench grinder, designed for tool sharpening, wire brushing and buffing has been developed by the Black & Decker Mfg.

6" Heavy duty grinder

Co. The streamlined housing is made of die-cast zinc. The wheel guards and covers are of steel to give extra protection. They are wide enough to accommodate a standard 3-section wire wheel brush without any change in the guard. Fitting around the grinding wheel for improved support in tool sharpening are adjustable U-shaped tool rests. The 2-pole push-button switch is recessed in the housing to prevent accidental contact yet it remains easy to reach. On the face of the grinder base a machined hole is provided for mounting attachments commonly used on bench grinders.

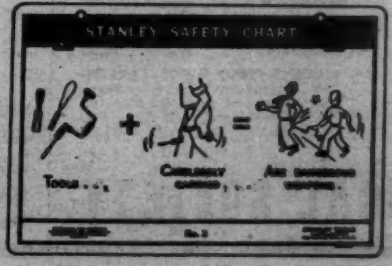
The grinder can be bolted to a bench or mounted on a new streamlined pedestal. Standard equipment includes two grinding wheels; medium grade for rough fast work; fine grade for finish grinding and tool sharpening.

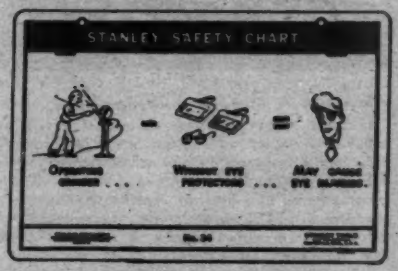
For brief reference use IAVE—0201.

NEW STANLEY SAFETY CHARTS

An attractive and useful set of safety charts has just been published by the Educational Department of Stanley Tools, New Britain, Conn. It is especially designed for use in the school shop.

The set consists of 18 cards, each carrying two safety messages — one on the front and another on the back of the card. The set, therefore, consists of 36 safety hints, each of which is illustrated with humorous sketches. The charts are printed on heavy cardboard, and they are pro-





vided with two large metal grommets at the top so that they can be hung up or removed readily.

With 36 safety messages available, instructors will find it advisable to exhibit one or two each week and make them the subject of the safety discussion for that week. The charts are lacquered so that it is easy to keep them clean.

They are offered at the cost of production plus mail charges — $2.50 per set in the U.S.A. ($4.10 in Canada, payable in Canadian funds). Mail check with order to Stanley Tools, Educational Department, New Britain, Conn.

For brief reference use IAVE—0202.

NEW ROTARY FILES AND GROUND BURRS

Nicholson File Company of Province, R. I., is now making a line of rotary files and ground burrs with ⅛-in. shanks. Used for relatively delicate operations, these supplement Nicholson's line of rotary files and burrs with ¼-in. shanks which were introduced by the firm two years ago.

Nine standard styles or shapes are offered in either hand-cut (rotary files) or ground from solid (burrs). Stock diameters of heads range in sizes from 1/16 to 5/16 in. Shanks are code stamped for easy identification.

(Continued on page 34A)

351 EIGHTH AVE. LAKE CITY, MINNESOTA

THESE
Fine Plywoods
can double enthusiasm for Wood-Working Projects!

Your students will find an extra thrill in working with fine plywoods—Mahogany, Curly Birch, Bird's Eye Maple, Haveila! They'll put more interest and care into their work—take extra pride in the added beauty of the finished project.

We have available a complete stock of fine plywoods in many standard thicknesses, and in a variety of panel and cabinet grade sizes especially suited for the school workshop. Send today for complete catalog of plywood and craftsmen supplies.

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Famous Soldering Products

Here's an opportunity to learn the advantages of Rubyfluid Soldering Flux. This trial will convince you that with Rubyfluid you get stronger unions and save time. You'll find Rubyfluid wets out freely, acts faster, has no objectionable or harmful fumes.

Send for this special sample order today: 1 pint of liquid and one-half pound of paste flux — together with Ruby's new booklet of simplified instructions and suggestions, "How to Solder," for only $1. Write to

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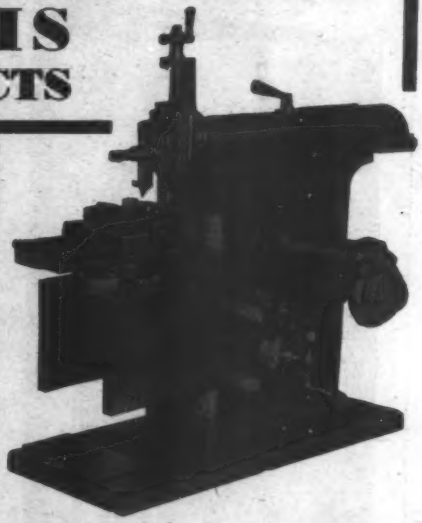
For sounder *initial* training use
LEWIS PROJECTS



The skillful machinists of tomorrow are receiving their initial training today with Lewis Projects. Developed to give sound training in machine tool fundamentals and accuracy in workmanship, they are furnished in rough or semi-finished castings with necessary assembly blueprints. Completion and assembly enable schools to equip their shops economically and give students the "know how" of machine tool construction and operation.

Lewis Projects are available in shapers, mills, jointers, circular saws, etc., at extremely low prices. Savings are as high as 80% of usual costs of comparable finished tools.

Write today for further information on the Lewis Shop Projects. Ask for the illustrated catalog—sent free.

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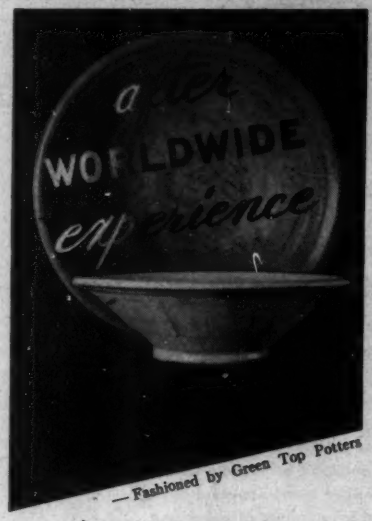
P.O. Box 7446 Station I, Dept X, Los Angeles 23, California

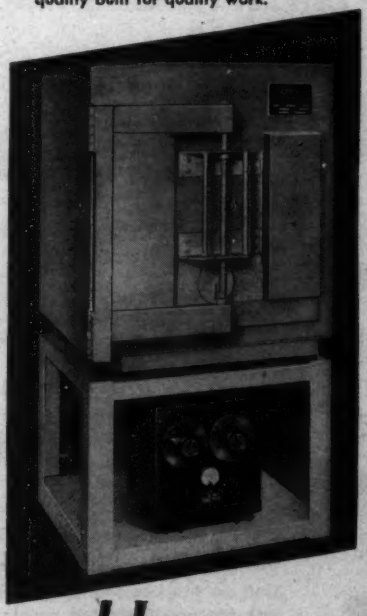


— Fashioned by Green Top Potters

Henry Jewett Greene writes: "We are not only satisfied but delighted with our Harper Kiln."

Following experience with many types of kilns in many parts of the world, Henry Jewett Greene, one of America's foremost authorities on pottery, ordered a Harper Electric Kiln for the studios of the Green Top Potters of Petersham, Mass.

The enthusiastic comment headlined above speaks for his satisfaction as well as that of other Harper users. Write for descriptive bulletins showing how Harper Electric Kilns are quality built for quality work.



Harper

ELECTRIC FURNACE CORPORATION

1445 Buffalo Ave., Niagara Falls, N. Y.

(Continued from page 32A)

Assortments of 18 hand-cut rotary files or 18 ground burrs are available. These come packaged in a cellophane-covered box which acts as a handy bench stand and protects the files when they are not in use.

Ground burrs

Tool, die, pattern, jewelry, dental, and optical shops are among those who will normally find good use for rotary files and burrs with ¼-in. shanks.

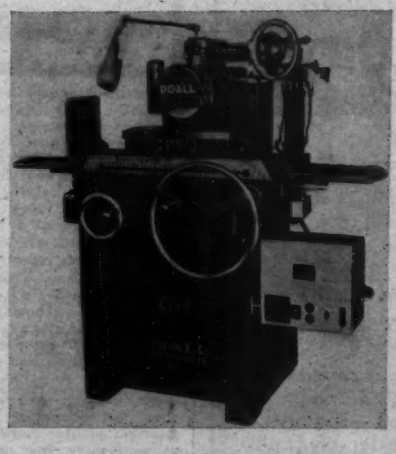
For brief reference use IAVE—0203.

NEW DOALL HAND OPERATED GRINDER

The DoAll Company, Des Plaines, Ill., announces the addition of Model GH hand operated toolroom surface grinder.

Hardened gears running in needle bearings and driven by a 16-in. handwheel make possible smooth, easy table action. The sturdy 1-in. cross-feed screw, located in the center of the saddle, assures accurate cross-feed action.

The Model GH has heavy, deep *V* ways between saddle and base and one *V* and one flat



New DoAll Grinder

way between table and saddle. All ways are handscraped and are automatically lubricated by a gravity feed oiling system.

The direct drive spindle has superprecision ball bearings throughout, with automatic take-up for wear. The direct coupled 1 h.p. motor and the spindle itself are statically and dynamically balanced and are totally enclosed.

The DoAll hand-operated grinder is designed for grinding to very close tolerances. The cast-

(Continued on page 36A)

BOWS and ARROWS

The all around good shop project that is useful, educational and entertaining. The FLAT BOW book shows how 75c; excellent flat lemonwood staves $15.90 dz.; tips, nocks, ground base feathers, good cedar shafts for 100 arrows $15.25.

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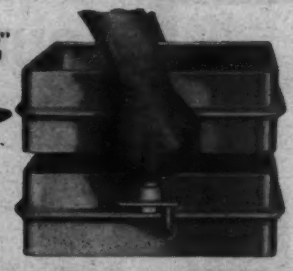

STERLING STEEL FLASKS
for Strength and Rigidity!

All-steel, all-welded, with high carbon content, Sterling Flasks combine maximum strength with minimum weight. Solid center rib and solid sand flanges at top and bottom. Full width bearing. Combination pin lugs and handles simplify handling and speed up the molding job.

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They cost no more than any others.

Ask for them by name.

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"The Clamp Folks"

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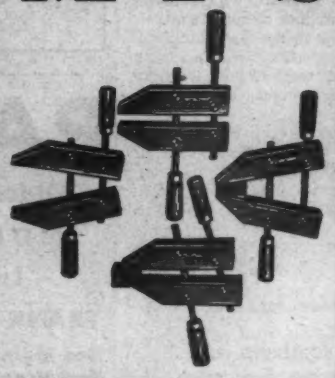

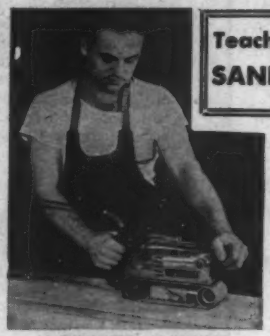

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● *TAKE-ABOUT pays its own way on refinishing desks, table tops, blackboards and in doing other maintenance jobs. Write for details and complete list of important features.*

PORTER-CABLE MACHINE CO.

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The Shop Annual Number renders a comprehensive service promoting the introduction, progress, and expansion of industrial arts and vocational education. It provides an authoritative source of information and guidance in organizing, planning, and equipping school shops.

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LEPAGE'S MODEL AEROPLANE GLUE

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WITH SPECIAL APPLICATIONS FOR THE SHOP TEACHER

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Cloth, 160 pages, $1.75

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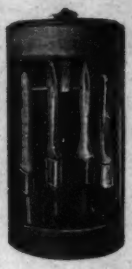

PROTEXEM BRUSH CONDITIONER employs new 'VAPOR ACTION' principle. A special solvent evaporates within the conditioner. Its vapor is a powerful solvent for the paint, varnish, enamel or lacquer in the brush. 'HARD-AS-ROCK' brushes are thoroughly softened. Keeps good brushes always ready to use.

Does Not Damage Bristle or Setting, Thoroughly Tried and Tested, Fully Guaranteed

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Extra pints of liquid..... .50

One pint of liquid will keep your shop brushes ready to use for 4 to 10 months.

Will hold six average size brushes.

Information on request

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METALS

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Sheet Brass — Copper — Aluminum Nickel and Sterling Silver, also

Hammers — Files and Anvils for working these Metals

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ings used are of nickel alloy, and the one-piece base and column extend from the bottom of the base clear up to the spindle in order to give extreme rigidity to the grinding wheel.

The elevating screw and the cross-feed screw operate through 4-in. bronze nuts to minimize wear. The handwheel for the spindle elevating screw is graduated in half thousandths with vernier adjustment to .0001. The handwheel for cross-feed is graduated in thousandths with vernier adjustment to .0001.

The working area of the table is 6½ by 19¾ in., with a maximum work height of 12 in., using the standard 7 by ½ by 1¼-in. grinding wheel.

DoAll electro magnetic chucks, a.c.-d.c. rectifiers and demagnetizers, dust collectors, grinding wheels, and wheel dressing diamonds are available for the Model GH.

For brief reference use IAVE—0204.

CASTOLITE INSTRUCTION BOOKLET

The instruction booklet which explains how to use the new liquid plastic will be very helpful to those who are making their first attempt at using this crystal clear material which pours without heating and sets at low temperatures.

The booklet explains how to use Castolite, how to store it, what its properties are, and then explains by the step-to-step method how to apply the information in making several very interesting projects.

The material will be found very useful, either as a transparent or as a colored medium for producing book ends, paperweights, buttons, lamp bases, toys, tiles, ornamental pins of all kinds, and costume jewelry. This instruction booklet is priced at 15 cents.

For further information about Castolite, address The Castolite Co., Box A211, Kenilworth, Ill.

For brief reference use IAVE—0205.

CALROD "HANDY" SOLDERING IRON

A new Calrod soldering iron called the "Handy" iron has been introduced by the Industrial Heating Division of the General Electric Company for home, farm, school, and hobby shop use. It is rated at 85 watts, 115 volts. The new iron contains the G-E cartridge-type Calrod heater. The half-inch copper tip is brazed onto the iron, assuring fast heat conductivity and more soldering with less power.

"Hot Tips on Soldering," a booklet discussing the care and use of soldering irons and a supporting stand is given with each iron.

For brief reference use IAVE—0206.

STA-WARM TRIPLEX
3 Heat Glue Pot

A low cost, high efficiency quality Electric Glue Pot with 3 heating control —
1. Low—for intermittent use.
2. Med.—for continuous use.
3. High—for quick heating.
Write for details on its 27 advantages.
1 pt. - $6.75
1 qt. - 7.25
2 qt. - 9.25
Details also available on other Sta-Warms, 1 pt. to 8 qt., with automatic control.
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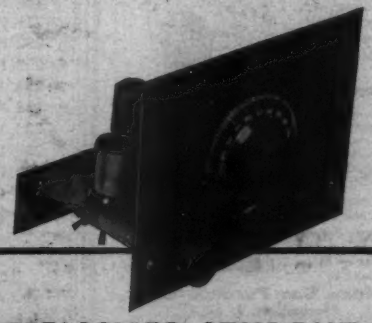

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